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THE COMMENTARIES UPON THE APHORISMS OF Dr HERMAN BOERHAAVE,

The late Learned Profeſſor of Phyſic in the Univerſity of LEYDEN,

CONCERNING

The KNOWLEDGE and CURE of the ſeveral DISEASES incident to HUMAN BODIES.

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THE COMMENTARIES UPON THE APHORISMS OF Dr. HERMAN BOERHAAVE.

BRITISH MUSEUM

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COM-

THIRD VOLUME

OF THE

CONTENTS

COMMENTARIES
UPON THE
APHORISMS
OF
HERMAN BOERHAAVE,
CONCERNING THE
KNOWLEDGE and CURE of DISEASES.

Of Wounds in the THORAX.

S. C T. CCXCVII.

WOUNDS inflicted in the thorax, are known to have not penetrated its cavity by inſpection, by the probe, by no air being diſcharged by any means, by the return of liquors injected warm, by placing the body in the ſame poſture as when it received the wound, and by certain ſigns that the lungs adhere to that part of the pleura which the wound has penetrated.

We call the thorax that part of the trunk of the body, which is terminated before by the ſternum, behind by the twelve vertebræ of the back, on the ſides by the arched ribs, above by the two ſuperior ribs, and below by the diaphragm, which ſeparates it from

the cavity of the abdomen. But as the diaphragm is placed obliquely, and forms a kind of arched roof, in ſuch a manner that its fore-part riſes much higher than its back-part, which is inſerted lower, it is thence evident that the cavity of the thorax is much larger behind than before. Internally this whole cavity is lined on all ſides with a very ſmooth membrane termed the pleura, which in a manner forms two hollow bladders, (as we explained it in § 170. numb. 4.) attached cloſe to each other near the ſternum, ſo as to partition the cavity of the thorax into two; and betwixt the meeting of theſe two pleuræ, is placed the pericardium with its incloſed heart, making the third chamber or cavity of the thorax.

Now in all wounds of the thorax, the firſt enquiry ought to be, whether they have penetrated its cavity or not? for when the wounding inſtrument has perforated the membrane of the pleura, or the pericardium, the wound may be then ſaid to have penetrated the cavity of the thorax, otherwiſe not. But a wound inflicted in the thorax may be very dangerous, and injure a great many parts without entering its cavity: for the pleura of each ſide having reached the ſides of the column of the vertebræ, recede from the ends of the ribs, and riſing up leave a conſiderable ſpace, which is occupied by the cellular membrane, through which the œſophagus, aorta, thoracic duct, *&c.* paſs. Therefore all the parts here placed may be injured, though the wound does not penetrate into the cavity of the thorax; but this will eaſily appear to be very ſeldom the caſe, becauſe theſe parts are defended pretty ſecurely by the column of the vertebræ behind them. But that a wound has not entered the cavity of the thorax, but only injured the external parts, may be known by the following ſigns:

By inſpection.] That is, when the wound is ſufficiently large, and runs in a ſtraight courſe.

By the probe.] Which being formed either of lead or ſoft ſilver, is to be introduced through the apertures

tures of the wound, without any force or violence. But it is eaſily apparent, that a change in the ſituation of the body, or the fat, concreted blood, &c. ſtopping up the wound, may eaſily obſtruct the paſſage of the probe, and afford a reſiſtance to the touch, notwithſtanding the wound penetrates into the cavity of the thorax.

No air being diſcharged by any means.] It was ſhown in the comment on § 170. nnmb. 4, that the ſurface of the lungs is always exactly contiguous to the pleura, while the cavity of the thorax remains entire, and that no air at all is contained betwixt the lungs and the pleura; but when a wounding inſtrument has perforated the pleura, the air may then enter and compreſs that ſide of the lungs, and thus the ſpace before filled by the lungs, will now be filled with external air. But this air being rarified by the heat of the parts, will in part eſcape through the wound, and more air will enter again; ſo that the air will continually enter and return by the wound, eſpecially if the perforation of the pleura is not very large; for then the lungs may be in ſome degree dilated by the air entering through the glottis, as we explained it more at large in the place above cited. In wounds of the thorax therefore, a ſkilful ſurgeon always enquires whether the air ruſhes impetuouſly through the wound, and this chiefly in the following manner. After the ſurgeon has compreſſed or cloſed the lips of the wound together with his thumb or fingers, ſo that no air can enter or return by it, he then orders the patient to inſpire as much air as he well can, and to retain the inſpired air in his lungs, by ſhutting the larynx; and then, before the patient breathes out the air, he places a wax candle oppoſite the wound, and ſuddenly opens its lips; if now any air entered into the cavity of the thorax, it will be forcibly blown out through the wound, ſo as to move the flame of the wax candle. For thus the air entered into the cavity of the thorax by the wound, will be

rarified by the heat of the body; and the lungs of the ſame ſide being alſo dilated by a violent inſpiration, and the inſpired air rarified by its retention and cloſing of the glottis, this will expand the lungs, ſo as to increaſe the compreſſure of the air contained in the cavity of the thorax, and which will therefore ruſh out impetuouſly and with a noiſe, ſo ſoon as a free paſſage is given to it by opening the lips of the wound. Now it is evident, that if the air thus ruſhes through the wound, it muſt certainly penetrate into the cavity of the thorax; but then the thorax may be perforated, and no air be thus diſcharged, becauſe by changing the poſture of the body from that in which it received the wound, the fat or fleſh may occlude the perforation; ſo that though a little air might have been admitted into the thorax, yet it cannot eaſily eſcape again for the ſame reaſon. This holds true, more eſpecially when the wound perforating the thorax is ſmall or narrow: and from hence we are therefore enabled to judge how far this ſign may be relied upon with certainty.

By the return of warm liquors injected.] This ſeems to be of all the moſt certain and ſafe method of determining the queſtion. For the ſearch by the probe may often be fallacious, ſince changing the poſture of the body may in a fat perſon occlude the perforation by the cellular membrane, which will obſtruct the probe from reaching to the bottom of the wound. And ſometimes the probe may enter near its whole length into the wound, without entering the cavity of the thorax; the wounding inſtrument having ſlid over the ribs into the fat, as we are taught by chirurgical obſervations. A ſtudent was ſo wounded in the right ſide of the thorax by a ſword, in ſingle combat, that the wound inflicted in the ſide as the body preſented obliquely, came out on the left ſide of the thorax, without at all entering its cavity, becauſe the ſword ſlid over the ribs. Warm water is to be injected by a ſyringe through the mouth of the

wound with a moderate force: and if a conſiderable quantity of water may be thus injected without any reſiſtance or apparent tumour in the cellular membrane, we then know that the water paſſes by the wound into the cavity of the thorax; but if a conſiderable reſiſtance is immediately felt, and the injected water returns by the mouth of the wound, this ſhews the contrary. Nor is any injury to be feared from this tryal, even though the warm water injected ſhould paſs into the cavity of the thorax; for it may be eaſily diſcharged again from thence by a convenient poſture of the body, and by the means we ſhall hereafter deſcribe in § 303: or even if it is left there, it will be abſorbed by the bibulous veins opening throughout the whole ſurface of the lungs and pleura; and that liquors contained in the cavity of the thorax may be thus carried off, we are taught by frequent experience. In an empyema, the matter has been found to be this way abſorbed and diſcharged with the ſaliva, urine, or by the inteſtines; and the ſame matter entering by the veins, and mixing with the blood, has been often tranſlated and ſettled upon divers other parts of the body. And thus Parey was ſurprized, after injecting a little liquor into the thorax to deterge and cleanſe the cavity, that the wounded perſon ſhould perceive an extreme bitter taſte, and have an inclination to vomit [a]; and therefore he abſtained from his medicines.

Poſture of the body, &c.] What conſiderable uſe a knowledge of the poſture of the patient's body when wounded may be of, towards determining the nature of the wound, and preſaging the conſequent maladies to be thence feared, we have already declared in the comment on § 168. numb. 1. For frequently it is altogether impoſſible to diſcover the courſe of the wounding inſtrument betwixt the parts of the body, unleſs the wounded patient is placed in the ſame poſture as when he received the wound. For the various actions of the muſcles may wonder-

[a] Les Oeuvres d'Ambroiſe Paré, Liv. X. Chapit. 32. pag. 251.

fully change the ſituation of the parts; as Euſtachius has well expreſſed in his anatomical tables, in the thirtieth of which the right arm is ſhown elevated, and the cubitus inflected, the left arm extended with the cubitus turned downward. If now we compare the right and left ſide of this figure, we ſhall ſee a conſiderable difference in the poſture of the parts.

By certain ſigns that the lungs adhere, *&c.*] Tho' the lungs, during life, always remain contiguous to the pleura, as well in expiration as inſpiration, as we are aſſured from phyſiology; yet the lungs are naturally at free liberty in the cavity of the thorax, adhering to the trachea by its air-veſſels, and to the heart by its blood-veſſels, but in no part naturally adhering to the pleura. Now the chief cauſe which prevents theſe parts from growing to each other, ſeems to be a thin dew or moiſture which is continually exhaled every moment of life from ſmall arterial ducts, which open throughout the whole ſurface of the lungs and pleura, and prevent the concretion of one with the other. And this circumſtance we find is beautifully obſerved by Hippocrates, with his uſual brevity or conciſeneſs of expreſſion, when he ſays, [b] *Omne enim non concretum, ſive cute, ſive carne tegitur, cavum eſt, impleturque ſanum quidem ſpiritu, infirmum vero ichore:* "For every part of the body which is not ſo-"lid or grown together, but lined either with ſkin "or fleſh, is hollow in a healthy ſtate repleniſhed "with vapours, but in a morbid ſtate contains ichor." But when the larger veſſels are ſo diſtended in an inflammation, as to compreſs theſe ſmall exhaling arteries, they will not then be able to diſcharge their thin liquor, but the dry ſurfaces of the inflamed membranes ſpeedily cohere together; whence it is that we ſo often meet with adhenſions of the lungs to the pleura after a pleuriſy, peripneumony, empyema, *&c.* If therefore it ſhall appear that the wounded patient has been afflicted with theſe diſorders, we ought then

[b] Hippoc. de arte, cap. 8. Charter. Tom. II. pag. 150.

to

to think of this adheſion: for if the wound entered a part of the thorax where the lungs adhered to the pleura, the inſtrument in that caſe might paſs a conſiderable length into the ſubſtance of the lungs, without perforating the cavity of the thorax. But this may be known, if the water injected by the mouth of the wound with a ſyringe, excites a cough, and is diſcharged through the wind pipe; for in this caſe the wound has entered the lungs without penetrating the cavity of the thorax.

Theſe are the ſigns by which it is uſually determined whether the wound has injured the external parts only, or alſo penetrated into the cavity of the thorax. But it may ſometimes happen, that all theſe ſigns, though accurately examined, may prove fallacious; eſpecially if the wound was inflicted by a narrow inſtrument; for then the fat may ſo cloſe up the wound after the inſtrument is extracted, that it will neither afford a paſſage to the air, probe, or injected water, and yet the wounded veſſels of the lungs may extravaſate their blood into the cavity of the thorax. It will therefore be neceſſary at the ſame time, to conſider whether the reſpiration is injured; for if the cavity of the thorax be leſſened either by the ingreſs of air or extravaſated blood, the reſpiration will always become more difficult: and if this ſymptom appears after a wound inflicted in the thorax, there is ſome reaſon to ſuſpect the wound both to be dangerous, and to have perforated the cavity of the thorax, even though no other ſymptoms are ſeen. The utmoſt caution is here neceſſary, leſt the ſurgeon or phyſician ſhould gain diſcredit, by ſuppoſing a dangerous or even fatal wound in this part, to be of little or no moment.

SECT. CCXCVIII.

IF the wound (297) deſcends obliquely above or within the ribs, even then matter is frequently depoſited in the cavity of the thorax by an eroſion of the pleura; and this more eſpecially, if the egreſs of the matter by the external wound is any how impeded; and thus an empyema is formed, from whence ariſe many bad conſequences.

Though it appears evidently that the wound does not penetrate into the cavity of the thorax, yet the worſt ſymptoms may follow thence. For if the wound deſcends deeply among the muſcles, and its orifice lies higher, the extravaſated humours will be therein collected, ſtagnate and corrupt ſo as to form various ſinuſes, and after eroding the pleura, it may at length paſs into the cavity of the thorax: the matter having once found a vent into the thorax from the ſinuous ulcer, will be daily augmenting ſo as to form an empyema; and the lungs thus ſoaking in corrupt matter, which becomes daily more acrimonious, will be themſelves conſumed; ſo that after the greateſt calamities death itſelf will follow. The maladies we now ſpeak of are always the worſt, when a ſinuous ulcer of this kind runs behind the ribs; for then there is no opportunity either to compreſs the parts, or dilate the wound to promote the diſcharge of matter. And if the boney or cartilaginous ſubſtance of the ribs and ſternum are affected, many other bad conſequences may again follow from thence, ſo as to render the cure extremely difficult, as will be more apparent, when we come to treat of diſeaſes in the bones. In confirmation of this, we have a remarkable inſtance given us by Galen[a]. A lad received a blow upon his ſternum in

[a] De Anatom. adminiſtr. Lib. VII. cap. 13. Chart. Tom. IV. p. 161.

the

the field of exerciſe; it was firſt neglected, and afterwards badly healed: but four months afterwards matter appeared in the part which received the blow; the phyſician inciſed the part, and ſoon enough brought it to cicatriſe, as he thought. But a new inflammation appearing afterwards, the part was again inciſed; nor could the wound be now brought to cicatriſation. Galen and ſeveral other phyſicians being called after this, found the os ſternum carious, and though all of them were unwilling to undertake the cure, Galen extirpated the foul part of the ſternum; and found the ſubjacent pericardium in part putrefied, ſo that he could ſee the heart naked; and yet the lad was cured in no long ſpace of time. This ſeems to be the caſe alſo which Galen mentions in the beginning of his firſt book, concerning the ſentences or opinions of Hippocrates and Plato, (the four firſt chapters of which book treat on the trunk only) where he ſays, he ſaw the heart as plainly in a lad, as when it is deſignedly expoſed by the diſſection of animals; and adds, that this lad was afterwards cured [b]. But above all, theſe bad conſequences are moſt to be feared, when the external diſcharge of the matter is impeded, either by the diſpoſition of the wound or a perverſe treatment.

SECT. CCXCIX.

THerefore emplaiſters, compreſſes, and tents ought not to be uſed in theſe wounds; but on the contrary, they ſhould be treated with ſoft deterging balſams, with pledgits of ſoft lint, and a ſlack bandage, aſſiſted by a convenient poſture of the body.

[b] Galen. de Hippoc. & Platon. placit. Lib. I. cap. 5. Charter. Tom. V. pag. 78.

Since

Since therefore ſo many and ſo great injuries may ariſe from wounds in the thorax, by the retention of humours extravaſated into the cavity of the wound, where they frequently make new paſſages through the cellular membrane, it is therefore evident that a free diſcharge ought to be procured for the matter with the utmoſt induſtry. But it is a common practice with ſurgeons in moſt wounds, and eſpecially in thoſe of the thorax, to introduce tents for preventing the upper orifice of the wound from healing before its bottom, and to make way for the diſcharge of foreign bodies contained in its cavity, and alſo to facilitate the application of medicines down to the fundus of the wound. But the very ſkilful ſurgeon Belloſte (to whom we owe the happy contrivance of perforating bones with ſmall foramina to regenerate their perioſteum, as we obſerved in § 252, 262.) was bold enough to oppoſe the torrent of this practice, and has with ſolid arguments demonſtrated the pernicious effects of tents in wounds, and eſpecially in thoſe of the thorax[a]: and he has likewiſe ſhewn by many good inſtances, that practice confirms what reaſon had thus dictated. For tents, formed of ſcraped lint contorted, or other of the like ſubſtances, being inſerted into the mouth of the wound, ſwell by abſorbing the extravaſated humours, inſomuch that they will thus ſoon thruſt themſelves out of the wound, if they are not reſtrained by a plaiſter or bandage: but if they are confined from being thus diſcharged, they ſwell and dilate the orifice of the wound by a ſlow laceration of its fibres and veſſels, not without extreme pain and irritation to the parts; and while they ſtop the orifice of the wound, they hinder the diſcharge of matter or other humours extravaſated, which will be therefore forced to make themſelves new paſſages, and may by that means convert the wound into a ſinuous ulcer of a bad condition; or elſe after eroding the pleura, they may enter the cavity of the thorax,

[a] Belloſte Chirurgien d'Hôpital, pag. 1—43.

and

and produce incurable miſchief. Add to this, that the capacity of the thorax is continually changing every moment of life, and the ribs with their connexed muſcles are perpetually in motion even in the moſt gentle reſpiration; whence ſuch a wound would never be at reſt, but continually rubbing againſt the ſides of theſe tents; from whence follow pain, inflammation, and at length a calloſity in the lips of the wound, which muſt be afterwards removed before the wound can be healed. From all which it is ſufficiently evident, that no good can be expected from the uſe of tents in wounds of the thorax. And though they may be in ſome meaſure ſerviceable in dilating the mouth of a wound too much contracted, yet they may be better and more eaſily performed by the knife, as we ſaid in § 238: or if a tent is required to be uſed for this purpoſe, the application of it for a day or two may be ſufficient, ſince this does not require the uſe of tents during the whole time of the cure. Even a tent of ſponge rightly prepared, (as we directed under the afore cited aphoriſms) being introduced into the orifice of the wound, will make a conſiderable dilatation of it even in a few hours. For the ſame reaſon it is alſo evident, why the uſe of tenacious emplaiſters is here pernicious: namely, becauſe they impede the free diſcharge of humours from the wounds. The beſt dreſſings therefore for wounds of the thorax are flat pledgits of lint, ſpread with ſome vulnerary balſam or ſoft digeſtives, according to particular circumſtances: over theſe to apply a plaiſter not too tenacious, but perforated with ſeveral ſmall holes, retaining them with a convenient bandage, when neceſſary; being yet cautious not to compreſs the mouth of the wound by the compreſſes or bandage; ſo as to hinder the diſcharge of the extravaſated humours.

Hippocrates obſerves, [b] *Quicumque thoracem vulnerati externa parte vulneris ſanati ſunt, interna non, periclitantur, ne ſuppurati fiant. Quibus autem debilis*

[b] In Coacis Prænot. N°. 430.

intus

intus facta fuerit cicatrix, facile diſrumpitur: "That "whoever, having a wound in the thorax, has the ex- "ternal part of the wound healed before the internal, "he is in danger of a ſuppuration or abceſs internally. "And in thoſe who have a weak cicatrix formed in- "wardly, it may be eaſily broke open." Hence it is evident, that the greateſt caution ought to be uſed to procure a conſolidation of the internal parts of the wound, before the external orifice is cloſed. This may perhaps ſeem to be an argument in favour of the uſe of tents, for preventing a concretion of the external lips in wounds; but if it is conſidered that the tent occludes the mouth of the wound in ſuch a manner, that the matter cannot be diſcharged, it will rather appear to hinder the conſolidation internally; ſince the matter confined in the wound will prevent the contact of the parts neceſſary to their union, and being accumulated, will form new paſſages betwixt the muſcles, and by that means increaſe the wound internally. But that it is contrary to the opinion of Hippocrates to ſtop up the mouth of ſuch a wound with tents may appear from another remarkable paſſage in the ſame author, which may ſerve to explain the paſſage laſt cited from his *Prænotiones Coacæ*. For he ſays, (uſing the ſame word ἔμπυοι, as in the laſt paſſage, and which is frequently uſed for an empyema, or collection of matter in the cavity of the thorax: *Quicumque à vulneribus purulenti fiunt ſive haſta, vel pugione, vel jaculo intus vulnerati ſunt, quamdiu quidem ulcus foras reſpirationem habeat per antiquum vulnus, & hac frigidum in ſe attrahat, calidum vero à ſe emittat, tum pus facile, tum ſane ſi quid aliud expurgatur. Et ſi quidem interna et externa pars ſimul ſaneſcant, omnino ſanus evadit. Sin vero externa quidem pars ſaneſcat, interna vera non, purulentus* (ἔμπυος) *fit. At vero ſi ſimul tum interna tum externa pars ſanata ſint, cicatrix autem intus debilis aſpera et livida exiſtat, quan-*

[c] Hippocrat. de morbis, Lib. I. cap. ix. Charter. Tom. VII. pag. 542.

doque

doque refricatur ulcus, et ab hoc purulentus evadit:
" That whoever, being wounded internally, either by
" a dart, ſpear, or dagger, has a congeſtion of mat-
" ter from the wounds, that matter, and indeed any
" other foreign ſubſtance, will be eaſily diſcharged,
" ſo long as the ulcer has a communication externally
" by the old wound, which matter is drawn in by
" cold, and diſcharged by heat. If now the internal
" and external parts conſolidate at the ſame time, the
" wound will be perfectly healed; but if the ex-
" ternal parts unite without the internal, a congeſtion
" of matter will be formed. But even when the in-
" ternal and external parts unite at the ſame time, if
" the cicatrix is internally weak, rough and livid,
" the ulcer will ſometimes return, and a congeſtion
" of matter be thence formed again."

From which paſſage it is ſufficiently evident, that the cure ought not to be attempted by the uſe of tents, to procure an equal conſolidation of the parts both internally and externally; but the poſture of the body ought to be ſuch, that the contained humours in the cavity of the wound may by their own weight ſubſide to the external opening; and when the bottom of the wound is lower than its orifice, and this cannot be remedied by a convenient poſture in the patient, compreſſes ought to be applied to the bottom of the wound, and a proper bandage uſed to force the contained humours to the opening of the wound; and thus the parts will readily unite internally at the bottom of the wound, when they are brought into contact by diſcharging the confined humours. In the mean time, the matter diſcharged by the external orifice, will eaſily prevent that from uniting before the internal parts are healed. But if the internal ſurface of the wound, being foul, requires to be cleanſed before it can be expected to heal; then thoſe remedies may be applied which we enumerated in § 207, and of which we ſhall alſo ſpeak hereafter in the cure of fiſtulæ. The uſe of theſe remedies ought to be continued

tinued till the wound affords a white, ſmooth, viſcid, uniform, inodorous and taſteleſs matter; and then a conſolidation of the wound, now cleanſed, may be attempted by an approximation of the ſides by a gentle compreſſure, carried gradually from the bottom of the wound towards its orifice.

SECT. CCC.

WE know that the wound penetrates into the cavity of the thorax, 1. by conſidering the cauſe and magnitude of the wound; 2. by ſearching with a probe, when the body is placed in the poſture in which it received the wound; 3. by the patient's drawing the air forcibly into his lungs while the wound is cloſed, and then ſhutting his mouth and noſe, to make the ſame effort as in expiration, when the air will ſuddenly ruſh through the mouth of the wound, and often form a ſound or noiſe by its agitation in the cavity of the thorax; 4. by inſpection; 5. by an emphyſema; when the air contained in the cavity of the thorax being continually augmented by the action of the wounded lungs, rarified, compreſſed by inſpiration, and its free eſcape through the wound prevented, by inſinuating betwixt the lips of the wound, forces its way into the cellular membrane, where increaſing, it often cauſes a ſoft pellucid tumour throughout the whole body, (excepting the ſoles of the feet, and palms of the hands) in ſome places to the thickneſs of eleven inches. See the hiſtory of the royal academy of Sciences for the year 1713. pag. 15, 18. alſo 4, 14. and 119, 120. where an

an account is given of a fatal emphyſema from a fracture of the ribs without a wound of the ſkin; 6. from the diſcharge of frothy blood.

Great caution is neceſſary in determining whether or no the wound penetrates into the cavity of the thorax; for this cavity aſcends much higher before than behind, where it deſcends lower: from whence groſs errors have been ſometimes committed, in thinking a wound penetrated the thorax, when it in reality entered the cavity of the abdomen. Thus we read in Ruyſch[a], of an ignorant ſurgeon dwelling in ſome part without the city, who being deſirous to perform the paracenteſis of the thorax, ſent for him into conſultation; but Ruyſch being indiſpoſed and unable to come, the ſurgeon by himſelf perforated the thorax as he thought; but ſoon after a large number of hydatids forced themſelves out through the wound, and the ſurgeon being affrighted, ſtopped the wound with a tent, and had recourſe to Ruyſch, but to no purpoſe, for the unhappy woman died ſoon after; and upon opening the body, nothing of water appeared in the thorax, but the ignorant ſurgeon in perforating the abdomen inſtead of the thorax had wounded the liver, which in that part adhered to the peritoneum, and ſeemed to have degenerated into hydatids, which burſt forth through the wound. From whence it is evident, how well one ought to be acquainted by anatomy with the true ſituation and connection of the diaphragm, in order to determine any thing with certainty in theſe wounds.

But wounds inflicted in the cavity of the abdomen may paſs into that of the thorax, by perforating the diaphragm: for diſcovering which there are no certain ſigns, and we ſeldom diſcover it but by opening the body after death: and of this we related ſome inſtances in the comment on § 170. numb. 4. But

[a] Obſervat. Anatom. Chirurg. Centur. Obſervat. LXV.

wounds

wounds properly ſaid to perforate the cavity of the thorax, of which we are now treating, are diſcovered by the following ſigns.

1. Since almoſt all inſtruments which wound with a ſharp point are of a conical figure; it is evident, that the width of the wound, compared with the wounding inſtrument, may indicate how far the inſtrument has penetrated: but then this ſign may deceive one, when the wound runs obliquely over the ribs among the muſcles; for in that caſe the wounding inſtrument may enter to a conſiderable length, without penetrating the cavity of the thorax.

2. Of this we treated in § 168. numb. 1. and § 297. where it appeared that by changing the poſture of the body from that in which it received the wound, the paſſage of the probe might be eaſily obſtructed by the intruſion of the fat, and by the different poſition of the muſcles.

3. Of this ſign we treated in § 297. But in performing this, great care is to be taken not to let any air paſs into the cavity of the thorax during the experiment; for by diſtracting the lips of the wound, in dilating the thorax by inſpiration, it may be very poſſible for air to enter its cavity: For in fat people the membrana adipoſa often ſtops up the wound penetrating the thorax, after the inſtrument is extracted, ſo that no admittance is given to the air; and therefore when this experiment is made, the lips of the wound ought to be firſt carefully compreſſed, and then the wounded patient, after having retained the air forcibly inſpired, ſhould next ſhut his noſe and mouth, and ſtrongly endeavour to make the effort of exſpiration. Thus the confined air expanded by heat will very much dilate the lungs, by which means the air lodged betwixt the lungs and pleura will be compreſſed, and likewiſe rarified at the ſame time by the warmth of the parts; the wound being now opened, there will be no danger of the external air entering through it into the cavity of the thorax, becauſe the

lungs

lungs greatly expanded will be applied cloſe to the ſides of the pleura, if no air is as yet contained in the thorax; but if any air has already entered its cavity, it will overcome the preſſure of the atmoſphere, by its rarifaction from the warmth, and compreſſure by the expanſion of the lungs, ſo that it will ruſh out forcibly through the wound. But if the wound was ſuch or ſo large as to admit a very free ingreſs of the air into the cavity of the thorax, and yet not ſo large as to much exceed the aperture of the glottis, (*vide* § 170. num. 4.) in that caſe the air will enter into and return out of the cavity of the thorax by the wound with a very manifeſt noiſe; and then there is not the leaſt room to doubt of its penetrating.

4. Of this ſign we treated in § 267.

5. We took notice of this wonderful ſymptom before, in § 244, ſo far as it ſometimes attend wounds of the head: but it is much more frequently an attendant on wounds of the thorax penetrating its cavity, in which this ſurprizing kind of tumour may be ſpread in a little time throughout the whole body. For the air having entered into the cavity of the thorax through the wound, whoſe external orifice is at the ſame time cloſed by the fat, ſticking plaiſters, or other dreſſings; this confined and rarified air often forces itſelf a way into the cellular membrane, or ſpreads through the panniculus adipoſus. But more eſpecially very large tumors of this kind ariſe, when the air-veſſels of the lungs are injured by the wound, ſo as to depoſite their inſpired air into the cavity of the thorax; for in that caſe the malady increaſes every moment. Parey gives us a wonderful caſe, reſulting from this cauſe which we before related from him in the comment on § 249. In this caſe the wind-pipe appeared to be wounded in the neck, and the air eſcaping from the wound inſinuated into the cellular membrane or panniculus adipoſus, and ſo ſurprizingly tumified the face, that neither eyes nor noſe could be diſcerned. And when the wounded patient was given

over by others, a ſkilful ſurgeon by making deep ſcarifications into the panniculus adipoſus, diſcharged the included flatus, and in a manner recovered the patient from the jaws of death [b]. A wonderful emphyſema following a wound of the thorax, penetrating the ſubſtance of the lungs, is deſcribed in the memoirs of the royal academy of ſciences at Paris [c]. A man thirty years old, of a ſanguine and fleſhy habit, received a wound penetrating the cavity of his thorax, of which he expired on the fifth day. But before death his whole body was ſurprizingly ſwelled with an emphyſema, excepting the ſoles of his feet, palms of his hands, and the vertex of his head. Upon the thorax this tumour was eleven inches thick; upon the abdomen, nine; in the neck ſix, and in the other parts of the body it was four inches. The eyes in this dead body were in a great meaſure thruſt out of their orbits, from the cellular membrane being diſtended with a great quantity of air. There is ſtill another extraordinary caſe of this kind mentioned in the ſame book [d], of a fatal emphyſema ariſing from a fracture of the ribs, the ſkin remaining entire. A man ſixty years old had the fourth and fifth of his true ribs broke in the middle of the left ſide, by ſome wheels paſſing over his breaſt: ſoon after a conſiderable ſwelling appeared in the affected ſide, from the entrance of the air into the panniculus adipoſus; which tumour increaſed daily, with a difficulty of reſpiration, till on the fourth day after the accident the man expired. In this body an emphyſema appeared all over its ſurface, except the palms of the hands and ſoles of the feet. Upon dividing the ſkin and the reſt of the integuments which covered the broken ribs, a ſmall and ſcarce perceptible aperture was found thro' the intercoſtal muſcles, without any ecchymoſis; and upon opening the thorax, a ſmall laceration was

[b] Les Oeuvres d'Ambroiſe Parè, Liv. X. Chapit. 30. pag. 249.
[c] Acad. des Sciences, l'an. 1713. Mem. p. 5, &c.
[d] Ibid. Mem. pag. 154, &c.

obſerved

obſerved in the external membrane which inveſts the lungs, part of the membrane adhering yet to the lungs, and part to the broken rib; but no extravaſated blood was found in the cavity of the thorax.

From hence it is ſufficiently evident, that emphyſematous ſwellings frequently ariſe from wounds in the thorax; eſpecially when the wound admits air into the cavity of the thorax; while at the ſame time it is by any cauſe prevented from eſcaping again through the orifice of the wound. But theſe obſervations teach us, that the very largeſt of theſe emphyſematous tumours will be produced, if the lungs are alſo injured ſo as to tranſmit their air into the cavity of the thorax; eſpecially when there is no conſiderable hæmorrhage at the ſame time: for the blood filling the cavity of the thorax, would prevent ſo large a quantity of air from being accumulated in the cavity, ſufficient to inflate the cellular membrane of the whole body. Hence the reaſon is alſo evident, why one may juſtly conclude the wound has penetrated the cavity of the breaſt, when one of theſe emphyſematous ſwellings appear ſoon after a wound inflicted in the thorax.

6. This ſign certainly denotes the lungs to be injured: for in that caſe the blood, flowing from the wounded blood-veſſels into the air-veſſels of the lungs, by mixing with the air it will become frothy; and therefore frothy blood will be coughed up from the wind-pipe, or elſe the ſame blood will run in a ſtream from the external wound. But the lungs cannot be injured, unleſs the wounding inſtrument ſhall have penetrated into the cavity of the thorax, except the lungs ſhould happen to adhere to the pleura in the part wounded, of which we treated in § 297. [e] Virgil has beautifully expreſſed this circumſtance, where he deſcribes Antiphaten to be wounded by Turnus.

[e] Æneid. Lib. IX. verſ. 700, &c.

Volat Itala cornus
Aera per tenerum, ſtomachoque infixa ſub altum
Pectus abit: reddit ſpecus atri vulneris undam
Spumantem, & fixo ferrum in pulmone tepeſcit.

For the ſame reaſon if frothy blood is ſpit in diſeaſes, it is ſuppoſed to come from the lungs.

SECT. CCCI.

THE effects or conſequences of ſuch a wound are frequently, 1. a preſſure of the air, which has entered the thorax, upon the ſurface of the lungs, by which means they are indiſpoſed both for reſpiration and for circulating the blood; 2. an extravaſation and accumulation of blood within the cavity of the thorax; 3. a putrefaction of the juices which are extravaſated, heated, agitated, and confined on all ſides; 4. Hence a maceration, eroſion, corruption, and fætor of the pleura, lungs, mediaſtinum, diaphragm, and pericardium; 5. an infinite number of diſorders ariſing from theſe laſt; 6. ſpitting of blood.

We have here enumerated the diſorders or accidents which have been ſometimes obſerved to follow wounds penetrating into the cavity of the thorax; all which reſult either from the admiſſion of the air, or the extravaſation of the juices.

1. It was before demonſtrated in the comment on § 170. numb. 4. that naturally there is never any air, in a healthy perſon, betwixt the lungs and the pleura; and that this was neceſſarily required, in order that the lungs might be diſtended with air ruſhing through the glottis, by the dilatation of the thorax. Whence it follows, that ſo ſoon as the air is admitted by a wound, into the cavity of the thorax, it will evi-

evidently impede the free expanſion of the lungs, or even totally prevent their expanſion, if the wound is large. In the place here cited, we made it evident from various experiments, how far and under what reſtrictions, this aſſertion is true. For if the air has a very free paſſage through the wound, the lungs cannot be dilated; but if a ſmaller quantity of air enters through a narrow wound than can enter through the open rimma of the glottis, the lungs will then be in ſome meaſure expanded, though not to ſuch a degree as they ought in a ſtate of health. This is a thing very well expreſſed by Galen [a], when he ſays, *Notum vero eſt, inſpiratione per animantis os facta, tantum neceſſario perire ob vulnus, quantum ejus loco extrinſecus influit circumflui aeris in thoracem. Quanto autem minus inſpiraverit per os ad neceſſitatem, tanto etiam minus efflari; quanto autem efflatio decreverit, tanto vocem ſequi breviorem neceſſe eſt:* "It is a thing well known "that the inſpiration made by the mouth of an ani- "mal muſt neceſſarily be diminiſhed by a wound, in "proportion to the quantity of ambient air that "flows into the cavity of the thorax. But of neceſ- "ſity leſs air muſt be expired, in proportion as leſs "was inſpired by the mouth; but as much as the ex- "piration is leſſened, ſo much muſt the voice become "ſhorter from thence of neceſſity." If now the air which has entered the cavity of the thorax is from any cauſe confined, or prevented from eſcaping again through the orifice of the wound, it will be rarified or expanded by the heat, and by ſtrongly compreſſing the lungs, obſtruct the inſpiration and the dilatation of the lungs thence following: and which is required in the animal after birth, that the blood expelled by the right ventricle may paſs freely through the narrow extremities of the pulmonary artery. But the rational of all theſe may eaſily be deduced from the known properties of the air, and from thoſe requiſites which

[a] De Anatom. adminiſtrat. Lib. VIII. cap. 3. Charter. Tom. IV. pag. 172.

demonſtrated from phyſiology to be neceſſary for the performance of reſpiration, and for the free circulation of the blood through the veſſels of the lungs.

2. If for example the intercoſtal arteries were wounded, the extravaſated blood may be collected to a conſiderable quantity within the cavity of the thorax; for the adjacent heart drives the blood with a great force into theſe arteries; and the motion of the thorax in reſpiration prevents the injured arteries from reſting and cloſing ſo ſoon as they otherwiſe might. If at the ſame time the blood veſſels of the lungs are alſo wounded, it is very evident that a large quantity of blood muſt be ſuddenly accumulated; but if the largeſt blood veſſels paſſing out from the heart are injured, death ſoon follows. But if the blood thus extravaſated is not diſcharged by the external aperture of the wound, it will be collected in the cavity of the thorax, and hinder the free dilatation of the lungs, whence extreme anguiſh and difficulty of reſpiration.

3. The blood thus extravaſated and confined in a warm and moiſt place, and continually agitated in reſpiration, will therefore very eaſily degenerate and acquire a corrupt or putrid ſtate, eſpecially when the air has almoſt continually acceſs through the wound, penetrating into the cavity of the thorax; as alſo when the air is admitted into the cavity of the thorax in inſpiration, by a wound in the air veſſels of the lungs. The obſervations which have been made in ſurgery teach us, that this extravaſated blood will putrefy in a very ſhort ſpace of time. In our commentaries on § 172. numb. 3. where we treated of theſe diſorders, we related the caſe of a ſoldier who was wounded in the thorax in ſuch a manner, that he diſcharged blood by coughing from the mouth, and the ignorant ſurgeon ſo united the lips of the wound by ſuture, that nothing could diſcharge itſelf. Parey being called in on the next day, immediately cut open the ſuture, and with his finger removed the thrombus of congealed blood, which obſtructed the orifice

of

of the wound, and extracted eight ounces of blood from the cavity of the thorax, already fetid and corrupted. In a nobleman, who had received a wound from the thruſt of a ſword penetrating the cavity of the thorax, after the loſs of ſeven or eight pounds of blood, Belloſte [b] extracted ſix or ſeven ounces of blood already half corrupted, upon removing the dreſſings, towards the end of the day in which the wound was received, And Hippocrates tells us [c]; *Quodſi ſanguis ex vulnere aut vena fluxerit in ſuperiorem ventrem, neceſſe eſt illud pus fieri*; "That if blood runs from a wound or blood "veſſel into the thorax, it will of neceſſity turn into "matter." But it was demonſtrated before in the commentaries on § 172. numb. 1. where we cited a like paſſage from his aphoriſms, that by this term of ſuppuration he underſtands any kind of corruption of the blood whatever; as Galen has obſerved in his explanation of that aphoriſm.

4. The putrefaction ſo ſoon formed in the extravaſated blood, will be every moment increaſing; for there is here a very conſiderable heat from the vital viſcera adjacent; from whence the blood will be converted into a putrid maſs. The lungs lodging in this corroding and putrid liquor will themſelves be macerated and putrefied; and the like will alſo happen to the pericardium, pleura, *&c.* It appeared in the preceding paragraph, that the blood extravaſated into the cavity of the thorax may very ſpeedily corrupt; and that it may there acquire the higheſt degree of putrefaction we are taught by obſervations. In a man who was wounded in the back, ſo that the ſword entered the cavity of the thorax and penetrated the left breaſt, after the moſt malignant and preſſing ſymptoms, the paracenteſis of the thorax was performed; and on the ſixth day after the infliction of the wound a very conſiderable quantity of matter was diſcharged, but ſo fetid that no one dared to ſtay in the chamber

[b] Le Chirurgien d'Hôpital, pag. 93. [c] De morbis, cap. 2. circa finem. Charter. Tom. VII. pag. 533.

where the patient lay [d]. In another patient, after the third day from the reception of the wound, which Sculetus dilated, near a pound of blood diſcharged itſelf from the cavity of the thorax, but of ſo hot a nature, that it ſeemed to burn the patient as it ran out more than a flaming candle [e]. It is therefore no wonder that the ſubſtance of the viſcera may be conſumed and eroded by macerating in ſuch a putrefied maſs of humours, and which as we read in Hildanus [f] has produced the ſame effect on the compact ſubſtance even of the heart itſelf. A countryman employed in carrying of damp hay, received from thence an injury to his deſtruction; he felt a ſenſe of pain with a kind of oppreſſion at his heart, and complained of a difficulty in breathing; but four days afterwards he returned to his labour. But ſome days more being elapſed, he was taken with a burning fever, aſthma, delirium, watchings, faintings, &c. and expired on the eleventh day of the diſeaſe. In opening the body the pericardium was found replete with a foul matter, in which the heart, appearing to be in a manner ſurrounded, was found eroded or diſſolved for a conſiderable ſpace, towards the each auricle chiefly; and the lungs appeared to partake of the ſame diſorder.

5. The extravaſated humours may by their compreſſure or putrid and eroding acrimony diſturb or aboliſh all the functions of thoſe viſcera which are placed in the thorax. Hence a dyſpnœa of the worſt kind, violent palpitations of the heart, intolerable anxieties, inflammations, ulcerations, gangrene, &c. may follow in theſe parts. But the extravaſated blood putrefying and becoming attenuated by the heat of the parts, and by ſtagnation, may be abſorbed by the bibulous veins ſeated in the ſurface of theſe parts, and mixing with the blood may produce a putrid ca-

[d] Scultet. Armament. Chirurg. Obſerv. 43. pag. 255.
[e] Ibid. Obſerv. 50. pag. 262.
[f] Obſervat. Chirurg. Centur. 3. Obſervat. 27. pag. 106.

chochymy

cochymy of the worſt kind: from hence follow putrid and acute fevers, tranſlations of the abſorbed putrid matter to other parts of the body, a phthiſis, atrophe, and death. From all which it is juſtly concluded, that an infinite number of the very worſt diſeaſes may ariſe from humours extravaſated within the cavity of the thorax.

6. If blood be ſpit up immediately after the infliction of the wound, it is a ſign that the lungs are injured, eſpecially if it appears frothy: and therefore in that caſe blood may eſcape into the cavity of the thorax from the wounded veſſels of the lungs, unleſs perhaps the lungs ſhould adhere to the pleura in that part where the wound was received. If blood is ſpit up ſome days after the wound was received, that may proceed from the extravaſated blood being attenuated by heat and reſt, and re-abſorbed by the veſſels of the lungs. In what manner this is done I ſhall not diſpute; but certain it is, that even an empyema has been cured by a purulent ſpitting. In a true pleuriſy, the ſpitting of a yellow matter mixed with ſtreaks of blood often terminates the diſeaſe, as we are aſſured from innumerable practical obſervations. All this proves the poſſibility there is for the extravaſated blood within the cavity of the thorax to cauſe a bloody ſpitting.

SECT. CCCII.

THE ſigns of blood extravaſated within the cavity of the thorax are, 1. an orthopœna, or ſuch a difficulty in reſpiration, that the patient is obliged to breathe erect. 2. The patient's lying eaſieſt on his back, it being very uneaſy for him to lie on the wounded ſide, and impoſſible for him to lie on the ſound ſide. 3. The conſequences deſcribed before in (301). 4. A weight or heavineſs on the diaphragm. 5. A fluctu-

fluctuation of the matter. 6. The nature and ſituation of the inflicted wound. 7. Great weakneſs, with paleneſs and cold ſweats. 8. A conſtant increaſe of almoſt all the ſymptoms.

After it has appeared evidently, that the wound has penetrated the cavity of the thorax, another queſtion of great importance muſt then be aſked; namely, whether the divided veſſels have extravaſated any conſiderable quantity of blood within the cavity of the thorax? And this cannot always be eaſily determined, ſince many of the ſigns which we ſhall hereafter enumerate may prove fallacious; and therefore the concurrence of ſeveral of theſe ſigns is required in order to determine any thing with certainty in this matter. But it may be evidently of the worſt conſequence for a phyſician or ſurgeon to be miſtaken in his diagnoſis here, ſince the extravaſated blood ought to be diſcharged either by the wound or by making a new apertion: but if the thorax be thus perforated, while no blood is confined in its cavity, it will admit the air, which is always pernicious here, and the wound will be therefore irritated, *&c.* Whence it follows, that one ought to attend to every circumſtance with the greateſt caution, leſt the patient ſhould ſuffer by an operation without neceſſity, or the ſurgeon be injured in his reputation.

1. An orthopnœa is ſaid to be a ſhort, difficult, and noiſy reſpiration, which the patient can perform only with his neck and breaſt erect; and which always denotes, that the free expanſion of the lungs by the inſpired air is impeded from ſome cauſe. But ſince the blood extravaſated within the cavity of the thorax occupies the ſpace that the dilated lungs ought to fill, it is therefore very evident, that this may cauſe a difficult reſpiration. But while the patient holds his body in an erect poſture, the extravaſated blood preſſing by its weight on the diaphragm will augment the

the cavity of the thorax, by which means the lungs may then receive a ſomewhat farther expanſion; or at leaſt they may be dilated more in that poſture of the body than in any other. Yet if this ſign be attended to alone, it may deceive one: for the air, which entered the cavity of the thorax by the wound, may impede the free expanſion of the lungs and cauſe an orthopnœa. A ſpaſmodic conſtriction of the lungs in aſthmatic people produces the like diſorder; ſo that if the patient wounded ſhould have been ſubject to an aſthma, this will be no very certain ſign.

2. This is a ſign of very great moment. For the diaphragm deſcending or being continued lower on the back part of the body, much increaſes the capacity of the thorax; ſo that the blood extravaſated within the capacity of the thorax will naturally ſubſide to the lower and back part of the thorax, when the patient lies down; and the back part of the diaphragm will deſcend more eaſily, for the middle of it is tendinous, to which the broad baſis of the pericardium is attached, and therefore cannot eaſily be depreſſed, as we ſaid before in the commentary on § 170. numb. 4. from whence it is evident, that the extravaſated blood will be lodged eaſier in this poſture than in any other. But when the patient lies on the injured ſide, the poſture of the body will be more painful, though tolerable; but if the patient lies on the ſound ſide, the weight of the extravaſated blood will preſs the mediaſtinum and pericardium towards the other ſide of the thorax, whence its capacity will be diminiſhed, and the difficulty in reſpiration increaſed; which the patient in this poſture no ſooner perceives, but he immediately changes it or turns himſelf, even againſt his inclination, to avoid ſuffocation.

3. Theſe conſequences reſult chiefly from the putrefaction of the extravaſated blood, and the morbid impreſſion on the viſcera, which is made by ſuch a putrid maſs: ſo that from theſe we may indeed diſco-

ver

ver the exiſtence of extravaſated juices, but this frequently too late.

4. While the patient is fixed in an erect poſture, the whole weight of the extravaſated blood preſſes the diaphragm downwards: therefore at that time the patient perceives the ſenſe of an incumbent weight, with a pain about thoſe parts to which the diaphragm is connected. Frequently alſo a tumour appears in that ſide of the abdomen where the diaphragm is depreſſed; inſomuch that ſometimes, in an empyema, the diaphragm is ſo much depreſſed, and gradually extended by the quantity of the confined matter, that it cauſes the abdomen to protuberate in the manner of an aſcites.

5. Where there is any ſuſpicion of confined matter within the cavity of the thorax, Hippocrates[a] orders the patient to be ſeated in a fixed chair after the plentiful uſe of warm bathing; and while ſomebody holds his hands, the phyſician muſt endeavour to diſcern on which ſide the noiſe or fluctuation is made while the ſhoulder is ſhook. And the ſame method he takes to diſcover a latent dropſy in the cavity of the thorax[b], and to determine the place, by opening which the ſerum collected in the thorax may be diſcharged. But it is eaſily apparent, that this ſign may ſometimes deceive one, for while the extravaſated blood is collecting in the cavity of the thorax, it congeals by ſtagnating, and therefore renders its fluctuation very difficult to be perceived; alſo if the thorax is filled with a large quantity of blood, no ſound or noiſe will be heard upon ſhaking the body, by reaſon of the fulneſs; and therefore it is a prudent admonition of Hippocrates[c], when he ſays, *Quibus ſuppuratis, dum concutiuntur humeri, multus ſtrepitus fit, minus puris habent, quam quibus, difficilius ſpirantibus*

[a] De morbis, Lib. II. cap. 16. Charter. Tom. VII. pag. 568.
[b] Ibid. cap. 24. pag. 576. & De internis affectionibus, cap. 24. Ibid. pag. 656.
[c] In Coacis Prænot. n°. 432. Charter. Tom. VIII. pag. 877.

& melius coloratis, exiguus. Quibus autem ſtrepitus nullus ſit, valida tamen ſpirandi difficultas adeſt, & ungues lividi, pleni ſunt pure, & pernicioſe habent; " In " thoſe empyemas, where a great fluctuation is heard " upon ſhaking the patient's ſhoulders, there is leſs " matter, than where the ſound is weak in thoſe who " breathe more difficultly, and are better coloured. " But in thoſe who have no fluctuation, and are yet " attended with a very difficult reſpiration and livid " nails, theſe are full of matter and in a deplorable " ſtate."

6. For when we know the ſeat of the wound and the courſe of the wounding inſtrument through the parts, we can then tell from anatomy whether or no any large artery or vein is injured. Thus the larger trunks of the intercoſtal arteries run near the lower margin of the ribs; thoſe of the internal mamillary are placed near each ſide of the ſternum, at about the diſtance of a finger's breadth from that bone, behind the cartilages of the ribs. The large vena azygos is ſeated on the right ſide of the vertebræ of the back, *&c.* from a thorough knowledge of all which the wound is concluded to be more or leſs dangerous.

7. There are ſome men ſo puſilanimous, that they will fall down into a deliquium at the ſight of the wounds of others; and in ſuch, all theſe ſymptoms may happen, though they are but ſlightly wounded. But in ſuch a caſe they eaſily recover themſelves by the aſperſion of cold water, or the exhibition of a ſtimulating cardiac; nor does the weakneſs continue long which thence ariſes. But when, after the infliction of a wound penetrating the cavity of the thorax, there directly follows great weakneſs, a contraction and paleneſs of the face, a languid pale look of the eyes, a cold ſweat gathering in drops upon the ſkin, eſpecially upon the face and breaſt, and the pulſe is found ſcarce diſcernible; we then know, that by the wound of the veſſels ſo large a quantity of blood is extravaſated, that ſcarce any returns to the heart, but

that

that the whole maſs is either diſcharged from the wound externally, or elſe collected within the cavity of the thorax. In ſuch a caſe therefore the moſt imminent danger ought to be declared to be at hand; for they ſuddenly expire. This has been well obſerved by Hippocrates[d], where he ſays, *Sanguinem profundentia cum ſudatiunculis vulnera maligna. Tales enim loquentes occulte pereunt:* "That wounds which have an "hæmorrhage attended with ſweats are malignant: "for ſuch patients expire ſecretly while they are "ſpeaking." In his[e] *Prænotiones Coacæ* there is alſo the ſame ſentence; only we there read, ἐφιδρώσιας for ἐπιῤῥιγώσιας, rigors inſtead of ſweats; but he elſewhere obſerves[f], that rigors follow large hæmorrhages, and ſays, that the rigor ſtops the flux of the blood: but then it is evident from what went before, that in this place he ſpeaks of a bleeding at the noſe. But when large veſſels near the heart have been injured by a wound penetrating the thorax, it is very evident that a rigor may here follow a large hæmorrhage, without producing any ſtoppage of the flux of blood.

8. The blood-veſſels here are very large, and very near the heart: and therefore the blood continues to flow from them into the cavity of the thorax, whence a preſſure upon the lungs, anxieties, difficulty of breathing, *&c.* which increaſe every moment till the hæmorrhage ceaſes, either from a contraction of the divided veſſels, or from a weakning of the patient's vital forces. Many ſymptoms may alſo follow in the patient thus wounded, from the fear, anger, or the like, which accompanies, and which gradually vaniſh; but thoſe ſymptoms which reſult from the hæmorrhage continue as that continues; and therefore a continual increaſe of the ſymptoms is always juſtly reckoned among the ſigns, by which we know that blood is extravaſated within the cavity of the thorax.

[d] Prorrhet Lib. I. num. 130. Charter. Tom. VIII. pag. 791.
[e] N° 328. Charter. ibid. pag. 870.
[f] Prorrhet. Lib. I. num. 152. Charter. ibid. pag. 799.

But

But when a wound penetrates any of the larger cavities of the body, and the ſigns denote that there is room to fear that the divided veſſels extravaſated their blood in full ſtream inwardly, though no hæmorrhage appears externally; in ſuch a caſe the prognoſis ought to be made with caution, leſt the reputation of the phyſician or ſurgeon ſhould be riſked, if they pronounced no danger: for frequently the patient thus wounded expires unexpectedly, and the death of the wounded patient is imputed to their ignorance, by thoſe who plead the cauſe of the wounder. But how carefully one ought to attend to all the appearances, in order to determine rightly whether or no any extravaſated blood is lodged in the thorax, is evident, inaſmuch as the moſt ſkilful are ſometimes deceived herein. The celebrated M. Mery[e] ingenuouſly confeſſes, that in a young man who was wounded with a ſword in the anterior and upper part of his right arm, within three hours after the wound was inflicted, he obſerved ſo many and ſo great ſymptoms, that he made no doubt but that the cavity of the thorax was full of extravaſated blood, and therefore began ſeriouſly to think of making the paracenteſis of the thorax. But the event afterwards taught that the caſe was otherwiſe, the patient being perfectly cured of his wound within the ſpace of eight days. But it ſeemed highly probable, that the tendon of the pectoral muſcle being injured, occaſioned the ſevere pain of the breaſt, great difficulty of reſpiration, *&c.*

SECT. CCCIII.

THE extravaſated blood ought to be immediately extracted, 1. by a convenient poſture, motion and ſtraining of the body; 2. by ſucking through a flexible tube, having holes in its ſides, and obtuſe at the end; 3. by injecting

[e] Academ. des Sciences l'an. 1713. Memoires, pag. 159.

ſome

ſome diluent, attenuating and deterging liquor: 4. by dilating the wound; or 5. by making another opening betwixt the ſecond and third of the lower true ribs, at the diſtance of four fingers breadth from the vertebræ, and as much from the lower angle of the ſcapula, making your inciſion with a knife, parallel to the ribs, betwixt the middle of them, and directing the edge downwards.

After it has appeared from the ſigns enumerated in the preceding paragraph, that extravaſated blood is lodged in the thorax, the curative indication then directs to immediately remove or extract it, leſt it prove injurious by its preſſure or putrefaction; and yet at the ſame time it ought to be particularly remarked that this extravaſated blood ſhould not be diſcharged before it appears that the injured veſſels have done bleeding. For of what ſervice can it be to diſcharge the blood, if by the motion of the body, ſucking, injections, or the like, the wounded veſſels yet open are ſo irritated, as to continue bleeding. When the pulſe appears ſufficiently ſtrong and equal, the extreme parts of the body feel warm, no hiccup or convulſion appears, and the patient's ſtrength continues, we then know that the internal hæmorrhage has ceaſed, and that the artifices required for diſcharging the blood from the cavity of the thorax, may be then ſafely uſed.

But it may be doubted whether the extravaſated blood ought always to be diſcharged by art, ſince it is apparent from the moſt faithful obſervations, that blood, matter, water, &c. has gradually vaniſhed from the cavity of the thorax, and being abſorbed by the veins, has been afterwards diſcharged by ſweat, urine, &c. Such a caſe is related by *Fabricius ab Aquapendente*[a]. A friend of his received a wound in

[a] Opera Chirurg. part. 1. Lib. II. cap. 22. pag. 214.

the

the thorax penetrating into its cavity, but ſo ſmall, that it could not be diſcovered to penetrate even by the probe; which yet appeared from the ſpitting of blood, the ſenſe of a weight preſſing on the diaphragm, a cough, fever, obſtructed reſpiration, &c. But ſince nothing could be extracted by the wound, the phyſicians concluded to make the paracenteſis of the thorax on the day following. In the mean time it happened, that the patient diſcharged a pot full of blood by urine, which relieved him from the pain, fever, and all the other ſymptoms. Another caſe of the ſame nature is to be found in Belloſte [b]. A captain received a wound penetrating the cavity of the thorax, and entering the lungs, and all the ſymptoms appeared which uſually attend ſuch wounds. When a vein was opened, inſtead of blood real matter was diſcharged to the relief of all the bad ſymptoms. Our author teſtifies, that this caſe was told him by a very expert ſurgeon, and confirmed to him by ſeveral eye-witneſſes of inconteſtible credit. A copious diſcharge by urine, or a plentiful ſweat, has been often obſerved of ſervice in the like caſes, by the ſame author [c]: And there are many more of the like obſervations to be met with; but theſe are ſufficient to prove, that nature, who ſo frequently aſſiſts herſelf, often cures ſuch wounds by extraordinary ways. But this does but rarely happen; and it is the part of a prudent phyſician to attend diligently whether the ſigns denote that nature is about to make ſuch an attempt: but in the mean time, if we were to truſt to nature only in theſe caſes, it is certain that many would periſh, from a deſtruction of the vital viſcera by the extravaſated and putrid blood, who by an artificial extraction of the ſame blood, might have been ſaved. This extraction therefore is to be attempted by the following means:

[b] Chirurgien d'Hôpital, pag. 265.
[c] Ibid. pag. 94, 95.

1. If the blood lodged in the cavity of the thorax is as yet fluid, and the wound being ſufficiently large does not run obliquely thro' the integuments, but directly penetrates into the cavity; in this caſe, if the patient be placed in a convenient poſture, the blood may deſcend by its own weight to the mouth of the wound, and diſcharge itſelf without other aſſiſtance. Therefore in ſuch a caſe the moſt ſkilful ſurgeons apply nothing to the orifice of the wound for ſome hours, that the blood may have a free exit. Thus Dionis [a] treated a man wounded into the thorax under the right breaſt. For when he found the cavity of the thorax full of blood, he firſt dilated the orifice of the wound, and then ordered the patient to lie all night on the wound, ſo that on the next morning he found the cavity of the thorax quite void of any blood, and the wounded patient was happily cured. Parey [b] ordered a man, who was wounded in the ſame manner, to be placed with his feet upwards, and his head downwards, and then introducing his fingers into the orifice of the wound, he removed the thrombus of congealed blood, extracted that which was extravaſated, and delivered the patient from imminent danger of ſuffocation.

This method of diſcharging the extravaſated blood from the mouth of the wound, is by a compreſſure of the abdomen either by the hands or by a broad roller, the patient at the ſame time retaining the inſpired air as long as poſſible, and then making the effort of expiration, while the glottis is cloſed; for thus the lungs being extremely dilated, and the diaphragm preſſed upwards, the blood extravaſated into the cavity of the thorax, will be preſſed out through the mouth of the wound.

2. Since it is often very inconvenient in many wounds of the thorax to keep the patient in ſuch a

[a] Operations de Chirurg. pag. 295, 296.
[b] Liv. X. Chap. 32. pag. 251.

poſture,

poſture, as that the extravaſated blood may diſcharge itſelf by its own weight through the opening of the wound: therefore another method has been contrived; namely, the introduction of a [f] flexible pipe, of gold, perforated in the ſides with many apertures, and furniſhed with a golden probe filling its cavity (which is to fit it for bending without diminiſhing or ſpoiling its cavity) which is to be carefully paſſed thro' the mouth of the wound, as low as poſſible into the cavity of the thorax; and then by ſucking, or by the application of a ſyringe, they evacuate the extravaſated blood. The apex or end of this tube is required to be obtuſe, to prevent it from injuring the lungs. A tube of the ſame form, and for the ſame uſe, may be made of lead; as alſo of flexible leather and whale-bone. With ſuch an inſtrument inflected like a ſyphon or crain, being introduced, and then drawing out the probe, [g] Scultetus extracted a large quantity of extravaſated blood from the cavity of the thorax, without making any ſuction.

3. It is eaſily apparent, that the two preceding methods take place only when the extravaſated blood is fluid; for if it has concreted into grumes, it will not eaſily eſcape through the mouth of the wound, much leſs will it enter the ſmall orifices of the introduced tube. It is indeed true, that congealed blood ſpontaneouſly diſſolves itſelf in time, but then it alſo putrefies, which is here very prejudicial to the patient: and frequently the anguiſh from the compreſſion of the lungs is ſo great, that one cannot poſſibly wait for this ſpontaneous diſſolution of the congealed blood. In this caſe therefore we inject into the cavity of the thorax warm water, with the addition of ſome honey, venice ſoap, and a little ſalt, (as we directed in the comment on § 236); this liquor being afterwards agitated by the motion of re-

[f] Scultet. Armament. Chirurg. Tab. XII. fig. 9 & 10.
[g] Ibid. Obſerv. 42. pag. 248.

piration, is in a manner blended with the concreted grumes, which are by this means diſſolved, ſo as to be capable of paſſing out with the injected liquor through the mouth of the wound. The injection is to be rendered medicinal, with different ingredients, according as different circumſtances may require. For diluting and diſſolving the concreted blood, warm water will be ſufficient, mixed with a little honey and ſalt; but when the extravaſated blood has already began to putrefy, it will be convenient to uſe an infuſion of ſcordium, rue, horehound, and the like gentle, deterging and antiſeptic ingredients.

4. Of this we treated before at § 238.

5. When the wound is of ſuch a nature, that it is impoſſible to diſcharge through it the liquors contained in the thorax, there is then no method left but to make a new opening in a part of the thorax, to which the confined juices have a natural tendency, from the internal figure of its cavity. This method is more eſpecially neceſſary, when the wound is inflicted in the upper part of the thorax; for then it is ſcarce poſſible for the extravaſated blood to paſs out through the orifice of the wound. But ſince the cavity of the thorax deſcends deepeſt towards the back, from the inclined poſture of the diaphragm, therefore the thorax is to be perforated in its back part, as low as can poſſibly be done without danger of injuring the diaphragm, which is attached to the lower ribs, and by aſcending forwards from the poſterior part of the thorax, forms with the bodies of the vertebræ a pretty acute angle. But to avoid injuring the ſtrong muſcles termed *ſacrolumbalis*, *longiſſimus dorſi*, *&c.* which aſcend through the loins and back on each ſide the *ſpina dorſi*; therefore the opening ought to be made at the diſtance of four fingers breadth at leaſt from the vertebræ. The opening is moſt uſually made betwixt the ſecond and third, or betwixt the third and fourth of the ſpurious ribs, reckoning from below upwards.

upwards. But ſince it appears from anatomy [h], that the diaphragm aſcends higher in the right ſide of the thorax, therefore when the paracenteſis of the thorax is made on the right ſide, it is uſually performed betwixt the third and fourth rib: but when on the left ſide, betwixt the ſecond and third of the ſpurious ribs, as *Van Solingen* [i] has obſerved. Perhaps it is for this reaſon that Hippocrates [k], enquiring which ſide of the thorax ought to be perforated in the empyema, wiſhed the matter to be lodged in the left ſide. Dionis [l] alſo directs to make the opening betwixt the third and fourth rib. Hence an error ſeems to have crept into the text of this aphoriſm, when it directs the place for inciſion to be between the ſecond and third of the true ribs, ſince in a paſſage that follows afterwards, the place is directed to be much lower; and in § 1191. numb. 3. treating of the paracenteſis of the thorax in the cure of an empyema, the place is directed to be betwixt the fourth and fifth, or fifth and ſixth ribs, counting upwards; which is the place that [m] *Ægineta* obſerves to have been perforated by ſome in the cure of an empyema, though he preſages either ſudden death, or an incurable fiſtula from the operation. I therefore believe that the text ought to be read, *betwixt the ſecond and third of the lower ſpurious ribs:* unleſs you will here underſtand the perforation to be made in the anterior part of the thorax, which may then be certainly the beſt made betwixt the ſecond and third of the true ribs, counting upwards, as [n] Dionis directs, who only mentions one advantage from making the paracenteſis in this part, namely, that the patient can dreſs his own wound in the abſence of the ſurgeon. But the greater profun-

[h] B. Siegfr. Albini Hiſtor. Muſculorum hominis, Lib. III. cap. 81. pag. 300.

[i] Manuale Operatien, &c. tweede deel, cap. 1. pag. 118.

[k] Hippoc. de Morbis, Lib. II. c. 16. Charter. Tom. VII. p. 568.

[l] Dionis Cours d'Operations de Chirurgie, Demonſtrat. 5. p. 296.

[m] Æginet, Lib. VI. cap. 44.

[n] Cours d'Operations de Chirurgie, &c. pag. 296.

dity of the thorax backwards, and the natural tendency of the blood towards a low aperture, when the patient is in a ſupine poſture, rather perſuade us to prefer the perforation of the thorax in its poſterior and lower part. Hippocrates [o], in treating of the cure of an empyema, though he does not directly point out the place to be inciſed, does yet determine it to be made in the loweſt and back part of the thorax. For he ſays: *At ſi præ craſſitudine & copia (puris) nullum ſtrepitum ediderit, quo illud deprehendatur (fit enim hoc aliquando) utrumlibet latus intumuerit, ac magis doluerit, illud infima parte ſecare (oportet) à poſteriori magis tumoris parte, quam ab interiori, ut facilis tibi ſit puris effluxus. Secare vero inter coſtas, &c.* "If the matter "ſhould from its thickneſs and great quantity yield "no fluctuating noiſe, whereby it may be diſcove-"red, as is ſometimes the caſe; which ever ſide is tu-"mified and moſt painful, there a perforation ought "to be made, rather in the loweſt and moſt back-"ward part of the tumour, than more forward, that "you may have a more eaſy diſcharge of the matter. "But to cut betwixt the ribs, *&c.*" And again, ſpeaking of the ſame diſeaſe, he ſays, [p] *Secare aut urere oportet quam proxime ad ſeptum tranſverſum, cavendo tamen ipſum ſeptum*; "You ought to make "your inciſion, or apply your cauſtic as near as poſ-"ſible to the diaphragm, taking care to avoid that "itſelf," *i. e.* not to injure it.

In a dropſy of the thorax, where the water is to be extracted, Hippocrates [q] directs to inciſe down to the bone from the laſt to the third rib, and then to perforate with a ſharp terebra, and after the perforation is made, he orders the water to be extracted by a little at a time, *&c.* From whence it is ſufficiently evident, that Hippocrates choſe the loweſt part of the

[o] De Morbis, Lib. II. cap. 16. Charter. Tom. VII. p. 568.
[p] Ibid. Lib. III. cap. penultimo, pag. 593.
[q] De internis affection. cap. 24. Charter. Tom. VII. pag. 656.

thorax

thorax, in order to extract the contained humours by perforating it.

The place being thus determined, may be eaſily found by counting the ribs, when the patient's body is unclothed: but when the patient is fat, or when an emphyſema attends, this may be more difficult to diſcover; and therefore ſurgeons have endeavoured to determine the part for inciſion by another method. They draw a ſtring ſtraight from the enſiform cartilage to the *ſpina dorſi*, and then divide the ſaid ſtring into three equal parts, and then they determine the place to be two thirds of the length of the ſtring diſtant from the ſternum [r]. Dionis [s] meaſures the diſtance of four fingers breadth from the lower angle of the ſcapula, and at the like diſtance from the *ſpina dorſi* he marks the place to be inciſed. But ſince the ſcapula is moveable, and may change its place by the different actions of the muſcles attached to it, it is evident that this method cannot be always very certain. It will be therefore beſt to examine the part thus pointed out by the fingers, to ſee whether it falls upon the interval betwixt the ribs.

When the part to be inciſed is thus known, it is uſually marked with ink, that it may not be loſt again: But as the ribs are moveable, 'tis very evident, that an alteration in the poſture of the body will alſo change the ſituation of the ſkin. Therefore Hippocrates [t] juſtly cautions, *Quum vero ſecare aut urere voles, nota impreſſa, fac ut eandem figuram ſervent inter ſecandam aut urendam, ne fallat cutis figuræ mutatione ſurſum vel deorſum vergens:* "That when "you would either inciſe or cauteriſe, making a mark "of diſtinction, cauſe the parts to keep the ſame "poſture during the inciſion or cauteriſation, that the "figure of the ſkin may not deceive you by its ſhift-"ing upwards or downwards." The opening ought

[r] Van Solingen Manuale Operatien tweede deel, cap. 1. p. 118.
[s] Cours d'Operations de Chirurgie, demonſtrat. 5. pag. 296.
[t] De Morbis, Lib. III. cap. penult. Charter. Tom. VII. pag. 593.

next to be made with a knife, or ſome cutting inſtrument, not with a pointed one, as in the paracenteſis of the abdomen, which is made by a ſteel bodkin, included in a ſilver canula; becauſe there would be great danger of wounding the lungs by puncturing in that manner. But in order for a cutting inſtrument to penetrate into the cavity of the thorax, the ſkin, panniculus adipoſus, *latiſſimus dorſi*, and intercoſtal muſcles, with the pleura muſt be divided; to perform which with ſafety, the patient ſhould incline his body a little backward to relax the ſkin, that the ſurgeon may elevate all the common integuments together, with the *latiſſimus dorſi*, if poſſible; and that being thus elevated, he may divide them at one and the ſame time, with a wound ſufficiently large, and of the length of three or four fingers breadth. This done, the patient ſhould incline his body a little backwards, and towards the oppoſite ſide, that the ribs may recede more from each other, and the intercoſtal muſcles be extended; then may the ſurgeon cut through the tenſe intercoſtal muſcles and pleura, with a ſcalpel a little crooked, along whoſe whole back the fore finger is to be applied, and at the ſame time the point of the knife is to be covered with the end of the finger, penetrating carefully into the cavity of the thorax by a ſmall wound, to avoid injuring the lungs: as ſoon as the pleura is divided, the lungs immediately collapſe and recede from the ribs; ſo that then the wound may be ſafely enlarged. But the inciſion is to be made parallel to the ribs, and in the middle ſpace betwixt them, directing the edge of the knife downwards to avoid the intercoſtal veſſels which lie hard by in a hollow ſulcus or groove in the lower margin of the upper rib.

With theſe precautions, this operation may be very ſafely performed; though there are ſtill a few more admonitions which occur in authors regarding the ſame, but which ſeem to be of leſs moment.

Thus

Thus *Fabricius ab Aquapendente*[u] will have it, that the patient ought to breathe out the air at the inſtant of making the perforation through the pleura, that by the receſſion of the lungs from the pleura at that inſtant, they may not be injured by the knife. But at this time of day we know from phyſiology, that the lungs are always contiguous to the pleura, both in expiration and inſpiration, and that they follow the dilatation of the thorax. Hippocrates[w] takes notice, that if the matter or water be all of a ſudden diſcharged either by inciſion or cauſtic, from a patient who has an empyema or dropſy of the thorax, it kills him; and therefore ſome would not have all the extravaſated blood extracted at once, but at ſeveral times. Now in an empyema, or in a dropſy of the thorax, the lungs have lain a long time macerating in the matter, or in the extravaſated ſerum flowing all around, ſo that upon diſcharging the whole maſs at one and the ſame time, the lungs might have their weakened veſſels burſt by the ſudden dilatation of them with blood, whence ſudden death. But when this operation is made in wounds of the thorax, it is very rarely that the caſe has been ſo long delayed, as to endanger any thing of this nature; and it appears from many chirurgical obſervations, that all the extravaſated blood has been thus extracted ſuddenly or at once with ſafety. What renders this operation the more eaſily practicable, is the compreſſure of the lungs by the extravaſated humours, and the depreſſure of the diaphragm by their weight, by which means thoſe two organs are not eaſily injured upon perforating the pleura.

It was obſerved in § 297. that the lungs ſometimes adhere to the pleura: now if this ſhould unluckily happen in the place where the paracenteſis is made, I ſay, if the lungs ſhould there adhere to the pleura, it is evident that this will occaſion no ſmall difficulty. Moſt

[u] Operat. Chirurg. cap. 45. pag. 490, 491.
[w] Aphor. 27. Sect. 6. Charter. Tom. IX. p. 263.

of

of the writers in ſurgery, who have treated on this operation, teſtify, that they have met with this accident; and they then direct the ſurgeon to prudently ſeparate the lungs from their adheſions to the pleura with his finger. At leaſt nothing more can be done than to make trial of this, though it may ſeem cruel thus to lacerate the adhering parts in a living man; but unleſs this be done, the paracenteſis is made to no purpoſe. There is an extraordinary place in Hippocrates [x], which ſeems to point at this. For he there deſcribes the ſymptoms which follow, when (ὁ πλεύμων προσφυσῶν ἐς τὸ πλευρὸν) *the lungs ſettle to the ribs or ſide*, and which agrees much with the appearances which are obſerved when the lungs adhere to the pleura, after acute or inflammatory diſeaſes of the thorax; and to this alſo the cure which he propoſes for the diſorder, very well agrees. But he afterwards adds: *Si vero ex vulnere illud fiat, aut empyico ſecto (fit enim) huic veſicam fiſtulæ alligans, flatu implere, & intus immittere, & penicillum ſtanneum ſolidum imponere, & ulterius repellere (oportet)*: "But if this happens in a "wound, or in the paracenteſis for an empyema, "you are to introduce a bladder faſtened to a pipe, "and fill it with wind; and you are afterwards to "make a farther ſeparation by a ſolid probe of tin." From which paſſage we may conclude, that in order to ſeparate the lungs from the pleura, Hippocrates introduced a complicated bladder through the wound, which he then inflated, and by the diſtention of the flatus within the cavity of the thorax, forced the lungs from the pleura, to which it adhered. At leaſt, it ſeems to follow, that this ſeparation of the lungs adhering to the membrane of the pleura, was attempted thus early. For fear of this adheſion, ſome adviſe to make a careful inciſion through the intercoſtal muſcles without wounding the pleura, which is then to be diligently examined, to ſee whether any unuſual thickneſs or calloſity of it gives any room to ſuſpect

[x] De Morbis, Lib. II. cap. 23. Charter. Tom. VII. page 575.

ſuch

ſuch an adheſion of the lungs to that part; and if ſo, it will be adviſeable to continue the inciſion a little longer, till you come to a part free from this coheſion. But this method of operating is more eaſily ſhewn in a dead body, than it is practicable in a living ſubject, where it ſeems very cruel to make ſuch a ſlow and gradual inciſion. And there are alſo ſuch ample adheſions of the lungs to the pleura ſometimes obſerved, as may even render this method of operating quite fruitleſs. Thus I obſerved in the body of a young nobleman, who died ſuddenly of an apoplexy following an hemopthoë, ſuch an adheſion of the middle lobe of the right ſide of the lungs every way to the pleura, as ſeemed to partition the right cavity of the thorax into two very diſtinct cells. If now in ſuch a condition of the patient a wound was inflicted in the upper part of the right ſide of the thorax, it is then eaſily apparent that the paracenteſis, made in its uſual place, would be of no manner of ſervice. But this is rarely the caſe; and a difficulty hence ariſing ought not to be aſcribed to any default of the artiſt, but to the art, ſince there are no ſigns by which ſuch an adheſion can be previouſly known.

The thorax being thus perforated, all the methods preſcribed in the preceding paragraphs may be then put in practice, to diſcharge the extravaſated blood. But if liquors are to be injected for diſſolving the concreted blood, it will be moſt convenient to convey them in firſt by the inflicted wound, becauſe of its ſituation in a higher part of the thorax, and then they may be eaſily diſcharged together by the new opening, when made.

SECT. CCCIV.

IF theſe wounds are not diſtended with any tents, are ſeldom opened, and ſecured from the air; that air which was admitted may be expelled

pelled by an artificial ſucking, and by proper efforts in reſpiration; and if the cold be alſo carefully avoided, the cure may be then compleated, when practicable, with eaſe and in a ſhort time.

We before propoſed (in § 299.) the reaſons for which the uſe of tents ought to be rejected in wounds not penetrating the thorax; nor do they ſeem to be leſs pernicious in ſuch wounds as penetrate into the cavity of the thorax. But if they are at any time to be uſed, it is when the juices confined in the cavity of the thorax are not to be all diſcharged at once but at different times, which though ſometimes neceſſary in an empyema or in a dropſy of the thorax, according to the admonition of Hippocrates, is very rarely required in wounds of the thorax; but in the former caſes they are inſerted into the wound to admit of a diſcharge of the juices ſtagnating in the cavity of the thorax when it ſhall be thought proper. Even Belloſte*, who in other caſes almoſt univerſally condemns the uſe of tents as pernicious, does yet allow, that they ought to be uſed for the firſt days after performing the paracenteſis of the thorax to prevent a concretion of the pleura divided in the recent wound. But afterwards they ſeem to be always pernicious, ſince they ſwell or dilate by abſorbing the juices, and rubbing againſt the ſides of the wound by the motion of the thorax, render them callous and more difficult to heal. Some think by the uſe of them to prevent the ingreſs of the air into the cavity of the thorax; but upon the removing the tent at each dreſſing, the air will have a very free ingreſs by the patulent orifice, and its diſcharge will be afterwards prevented by the intruſion of a new tent; ſo that, dilating by the warmth of the parts, it often makes itſelf ſurpriſing paſſages, and may produce the moſt malignant emphyſemata. It is therefore better to cover the mouth

* Chirurgien d'Hôpital, Part. III. Chapit. 6. pag. 228.

of

of the wound only with a flat pledgit, and leave a free paſſage for the humours to eſcape by the opening or wound, which being large, you ought then to be very careful that the pledgit does not ſlip into the thorax, which authors acknowledge has ſometimes happened to the introduced tents. A Daniſh nobleman being wounded, and negligently treated by the ſurgeon, the tent ſlipped into the cavity of the thorax, and was ſix months afterwards diſcharged by the mouth; and yet the patient enjoyed a ſtate of health after this [b]. A man was wounded with a ſword into the right cavity of the thorax near the axilla betwixt the ſecond and third of the true ribs; from which wound blood was diſcharged for the ſpace of fifteen days, and ſome blood was alſo ſpit up by coughing. After many and very troubleſome ſymptoms the wound at length was cicatriſed; but a difficulty in breathing ſtill continued with an inceſſant cough, and a ſpitting of a fœtid and greeniſh matter. Three months being elapſed from the cure of the wound, the patient brought up a couple of tents, with a good deal of matter, which had ſlipped into the thorax from under the emplaſter at different times during the cure of the wound [c].

Another thing required here is to exclude the air from entering through the wound into the cavity of the thorax; or if it has once entered, to diſcharge it from thence. But it is impoſſible to exclude the air ſo long as the extravaſated humours remain there, ſince they require a free paſſage; but then nothing more is diſcharged from the wound, then the air lodged in the cavity of the thorax, betwixt the lungs and the pleura ought to be extracted, and all poſſible care taken to prevent it from entering again. For it appears from phyſiology, that it is neceſſary there ſhould be no air in the cavity of the thorax, in order for the free expanſion of the lungs by inſpiration.

[b] Tulp. Obſerv. Medic. Lib. II. cap. 15. pag. 123, 124.
[c] Hildan. Obſerv. Chirurg. Cent. 1. Obſerv. 46. pag. 41.

Now

Now this diſcharge of the air may be procured either by ſucking, or by the method following, which is the beſt of any. Let the lips of the naked wound be preſſed together by the fingers in ſuch a manner, that no air can enter, and then let the patient draw in a large quantity of air into his lungs by a deep and long inſpiration, and let him retain this air as long as he well can: now the air thus retained being rarefied by the heat of the parts, will expand the lungs and compreſs the air lodged betwixt the lungs and the pleura. If then the lips of the wound are opened or drawn aſunder, a great part of the air confined in the thorax will be expelled; after this the lips of the wound are to be immediately cloſed again, before which the patient muſt not expire. By repeating this method ſeveral times the whole quantity of air may be entirely expelled from the cavity of the thorax, and the patient will directly perceive, that he can breathe much more commodiouſly. All the air being thus expelled, let a ſticking plaiſter be immediately applied at the inſtant when the patient retains the inſpired air in his lungs; at which time the lungs, being diſtended and contiguous to the pleura, will obſtruct the paſſage of the air about to enter through the wound. This emplaſter is to be continued upon the parts for a very conſiderable time; and when it is neceſſary to renew the dreſſings, another ſticking plaiſter of the like kind is to be applied with the ſame precautions; and if the ſeldom dreſſing of a wound is ever uſeful, it muſt certainly be ſo in theſe wounds of the thorax. The uſefulneſs of this method is proved by the experiments made on living animals, as deſcribed under § 170. numb. 4. For when each ſide of the thorax was perforated with a large wound, the reſpiration wholly ceaſed, and the animal ſeemed dead; but the intruded air being by this artifice expelled from the cavity of the thorax, the animal revived, and immediately recovered its voice which it had loſt.

But

But ſince all the parts contained in the thorax are near the fountain of heat, the heart, and are continually cheriſhed with a gentle warmth, therefore the utmoſt caution is to be uſed to preſerve them from the contact of the unuſual cold; and therefore a warm air is always neceſſary here, when the dreſſings are to be renewed.

By this method wounds of the thorax have been ſometimes cured, even though they have been very dangerous, and attended with the moſt ſevere ſymptoms; and that we ought not eaſily to deſpair in the worſt of them, may appear from the extraordinary obſervations given us, and of which ſeveral ſuch inſtances were related in § 170, from authors of the beſt repute. There is doubtleſs at all times reaſon to fear much danger in theſe wounds, ſince the vital viſcera, namely, the heart and lungs, with the largeſt blood veſſels of the whole body, are here ſeated: but ſince even wounds of the heart itſelf are not always abſolutely mortal, (of which viſcus Pliny ſays[a], *quod ſolum hoc viſcerum vitiis non maceratur, nec ſupplicia vitæ trahit, læſumque mortem illico affert*; "that this "viſcus only does not waſte with diſeaſes, nor does "it receive life from any other part, and being "wounded, produces inſtant death,") it is evident, that even in the moſt dangerous wounds there is always ſome hopes of a recovery remaining; ſince men have ſometimes recovered when they have been left for dead after wounds of the largeſt veſſels, when no manner of care was taken of them, nor any cordials given to ſtrengthen them. It is alſo not only evident, that the moſt dangerous wounds of this kind have been cured, but that even in a very ſhort time likewiſe. A captain had the right ſide of his thorax perforated with a ſword near the axilla, and in a very ſhort time loſt ſeven or eight pounds of blood; nor did the hæmorrhage ceaſe, even though the wound was dreſſed up with a ſuitable apparatus; and his

[a] C. Plinii Secundi Natur. Hiſt. Lib. XI. cap. 37.

pulſe

pulſe weak and unequal, frequent fainting fits, a fever, &c. afforded no good preſage. The day after, the hæmorrhage not yet ceaſing, the patient was obliged to change his place of reſidence, inſomuch that every one believed he would expire in the journey: and yet the wound being only covered with a plaiſter, the patient was ſo much relieved by a copious diſcharge of urine, a ſpitting of blood, and a profuſe ſweat on the next night, that all the ſymptoms vaniſhed, and the wound was in a ſhort time cured barely with an incarnative emplaſter, ſo that on the fifth day after the wound was received, he could ride a horſe very well, nor did he from that time any longer keep his bed in the day[c]. Many ſuch inſtances are to be found in the ſame author, which teach us, that the moſt violent wounds of the thorax, attended with the worſt ſymptoms, have been happily cured in a very ſhort time without the uſe of tents, and with ſeldom renewing the dreſſing.

SECT. CCCV.

AND thus all thoſe ſevere ſymptoms will be prevented, which we mentioned (301.)

The very worſt ſymptoms which appear after wounds in the thorax, ariſe almoſt entirely from the air admitted into its cavity, or from the extravaſated juices diminiſhing its cavity, or elſe corrupting and injuring the included viſcera. When theſe wounds are not filled with tents, the extravaſated blood has a free exit, and the ſeldom dreſſing, with the precautions before delivered, will prevent the air from entering, and that which has been already admitted may be expelled by the methods before deſcribed. By theſe means the cure always happily ſucceeds, unleſs ſome part be injured, without the integrity of which life cannot ſubſiſt: and it is alſo from hence appa-

[c] Belloſte Chirurgien d'Hôpital, Part. II. chap. 8. pag. 92.

rent,

rant, that the hiſtory and treatment of wounds in the thorax afford much light into ſeveral other diſorders of the thorax and its contained viſcera; as will afterwards appear, when we treat of the empyema and dropſy of the thorax.

Of Wounds in the Abdomen.

SECT. CCCVI.

WOUNDS of the abdomen not penetrating into its cavity are diſcovered to be ſuch; 1. by the probe, and by their courſe or ſituation; 2. by injection; and 3. from a knowledge of the nature of the wound, and of the wounding cauſe or inſtrument.

The trunk of the body is divided into two large cavities, of which the upper and leſſer is called the thorax, and the lower and larger the abdomen. But the cavity of the abdomen is divided from that of the thorax by the diaphragm; and therefore all the parts of the trunk below the diaphragm appertain to the abdomen, whether they be parts containing or contained. The whole circumference of the thorax is encompaſſed by the ribs; but the greateſt part of the abdomen is defended only with the ſoft integuments. For if we except the ſuperior and lateral parts of the abdomen on each ſide, which are encompaſſed by the ſpurious ribs, behind which the large liver and ſpleen are ſafely placed, as being the moſt friable or tender of the abdominal viſcera; to which if we add the column of vertebræ occupying part of the abdomen behind, and laſtly the inferior and lateral parts, which are defended by the oſſa innominata on each ſide; excepting theſe, all the other parts of the abdomen are ſoft. As the cavity of the thorax is inveſted on

all ſides with a membrane called the pleura, ſo the cavity of the abdomen is alſo every way lined with a ſimilar membrane, named the peritonæum. And from hence it is, that wounds of the abdomen are in general diſtinguiſhable like thoſe of the thorax: for all wounds injuring the containing parts of the abdomen without dividing the peritonæum, are called not penetrating; as thoſe which perforate the peritonæum are ſaid to penetrate into the cavity of the abdomen. But whether or no wounds thus penetrate, is diſcovered by the following ſigns.

1. Of this we treated in the commentaries on § 300. numb. 2. but in the abdomen the difficulty is ſtill greater, eſpecially in corpulent habits, where the abdomen is covered with a vaſt quantity of fat. From hence it is, that the moſt ſkilful ſurgeons have affirmed, that nothing certain can be diſcovered in theſe wounds by ſearching with the probe: for a change in the ſituation of the parts, a tumour of the lips of the wound, grumes of congealed blood obſtructing the wound, or the fat preſſed into the wound, may hinder the paſſage of the probe when it has been introduced at the mouth of the wound. To theſe add, that the patient is often ignorant of the poſture of body in which he was when the wound was inflicted.

2. As when warm water is injected by a ſyringe at the mouth of the wound: of which we treated in the commentaries on § 300. numb. 4.

3. For if from the figure of the wounding inſtrument, compared with the width of the wound, it ſhall appear to have penetrated deep and in a rectilineal poſition, we may then conclude the wound has paſſed into the cavity of the abdomen; and the reverſe, if from the ſame ſigns the wound ſhall appear to have been inflicted ſuperficially or obliquely. It is eaſily apparent, that a wounding inſtrument may penetrate to a conſiderable depth without perforating the peritonæum in thoſe who have their belly prominent with fat to the thickneſs of half a foot.

SECT.

SECT. CCCVII.

IF theſe wounds penetrate almoſt as deep as the peritonæum, the integuments being there weakened, may give occaſion for a hernia to be formed in a robuſt patient; than which nothing can be worſe, if the fiſtulous wounds run obliquely betwixt the integuments of the abdomen.

To what a degree the peritonæum may be extended is ſufficiently evident in women with child, and in thoſe afflicted with dropſies; from whence wounds, not penetrating the abdomen, have a circumſtance peculiar to themſelves, which being neglected has often produced a train of the worſt conſequences. For the diaphragm being depreſſed at every inſpiration, all the contents of the abdomen are thereby compreſſed, and again in exſpiration they are repreſſed by the abdominal muſcles; whence it is evident, that the contents of the abdomen receive a continual preſſure from the diaphragm and muſcles of the abdomen. If therefore the equality of this preſſure be removed in any part by a wound in the integuments extending almoſt to the peritonæum, that membrane being eaſily dilatable, will be extended by the force of reſpiration ſo as to form a ſacculus, into which the inteſtines, omentum, *&c.* may enter, and form an hernia, which is no more than a dilatation of the peritonæum in ſome part, into which the contained viſcera of the abdomen may prolapſe or enter. For it is very rarely, if ever, that an hernia is formed by a rupture of the peritonæum, but almoſt conſtantly from an expanſion of that membrane into a ſacculus; notwithſtanding Celſus [a] ſeems to have been of another opinion: and we are taught by moſt certain obſervations, that ruptures may be formed in any part of the abdo-

[a] Lib. VII. cap. 4. pag. 413. & ibid. cap. 17. pag. 454.

men where the equable preſſure is removed from the peritonæum. In the dead body of a woman, an hernia was found on the left ſide of the linea alba, four fingers breadth above the navel, and which contained a portion of the omentum and inteſtinum colon. This rupture aroſe from a violent blow received on this part of the abdomen [b]. Sennertus [c] relates a wonderful caſe, which teaches us, that a weakneſs in any part of the abdomen may occaſion very large hernial tumours. A cooper's wife, in helping her huſband to bend one of the ſtaves, was by the return of it ſtruck on the left inguen. A ſmall tumour aroſe ſoon after in the part, which in a little time increaſed greatly; it afterwards appeared, that the increaſing uterus of this unhappy woman, big with child, had got into a large ſack formed by a dilatation of the integuments of the abdomen; in which place the motion of the living fœtus might be perceived both by the eye and touch: and as there ſeemed to be no other remedy left at the time of birth, the infant was delivered alive by the cutting open of the womb; at which time Sennertus being preſent ſaw, that the peritonæum was not ruptured but entire, only conſiderably dilated by the bulk of the womb. After the cure of a wound in the abdomen, a conſiderable hernia was formed in the part where the wound had been made, which neglected by the man, he ſix years afterwards died of a gangrene in that part [d]. Now the ſtronger the perſon thus wounded is, the more liable is he to a future rupture there, becauſe the preſſure acts ſo much the ſtronger on the reſt of the abdomen, whereby the weaker place will be more eaſily and ſpeedily dilated. To which add, that ſtrong bodies are uſually employed in violent exerciſes, whence the leaſt reſiſting parts will be again more dilated by the greater efforts of reſpiration.

[b] Acad. des Sciences, l'an 1714. Mem. pag. 259.
[c] Lib. IV. part. 1. ſect. 2. cap. 16. Tom. III. pag. 39.
[d] Tulp. Obſervat. Medic. Lib. III. cap. 20. pag. 211.

Than

Than which nothing can be worſe, *&c.*] It is well known that a large quantity of fat is always ſeated upon the abdomen, unleſs the perſon is very lean: and this fat is not only ſpread upon the muſcles of the abdomen, but is alſo interpoſed every where betwixt them; if therefore a wound ſhould run obliquely betwixt the integuments of the abdomen, the extravaſated humours or matter there collected, and not meeting with a free diſcharge through the mouth of the wound from ſome impediment, often burrows or make its way ſurpriſingly through the ſubſtance of the panniculus adipoſis, and forms deep ſinuoſities betwixt the interſtices of the muſcles, in which caſe the cure becomes extremely difficult; and frequently it is even wholly impracticable to cure theſe fiſtulous ulcers following from wounds of the abdomen, ſince it is there neceſſary either to compreſs the bottom of ſuch a fiſtula by an artificial preſſure, while its aperture continues open; or elſe to lay open all its mæanders by inciſion. But that both thoſe methods are often impoſſible to be uſed in theſe caſes will readily appear to any one who conſiders the great thickneſs of the adipoſe membrane there, and the interpoſition of it betwixt the interſtices of the abdominal muſcles. Celſus[s] takes notice of theſe very bad fiſtulæ being formed here, when he ſays, *Ventri nullum os ſubeſt; ſed ibi perniciosæ admodum fiſtulæ ſunt; adeo, ut Soſtratus inſanabiles eſſe crediderit. Id non ex tota iter ſe habere uſus oſtendit*; "There is no bone placed "under the abdomen; yet there are very bad fiſtulæ "ſeated there, inſomuch that Soſtratus believed them "incurable. But that they are not always incurable, "experience demonſtrates."

But Celſus chiefly believed fiſtulæ of the abdomen to be dangerous, becauſe being laid open they occaſion ruptures; and therefore he ſays, *Tutior fiſtula eſt contra jecur et lienem et ventriculum, quam contra inteſtina; non quo perniciosior ibi res ſit, ſed quo alteri*

[s] Lib. VII. cap. 4. pag. 413. [t] Ibidem.

periculo locum faciat; "A fiſtula ſeated oppoſite to "the liver, ſpleen or ſtomach, is leſs dangerous than "one oppoſite to the inteſtines; not that the effects "are there worſe in themſelves, but becauſe they "there make way for another diſorder." Tulpius[a] laments an incurable fiſtula in a girl, which aroſe by a long and winding courſe from one of the ſpurious ribs which was carious. Many more of theſe caſes have been obſerved, of which we ſhall ſpeak more largely when we come to treat on fiſtulæ; it will be ſufficient at preſent to produce one or two inſtances. A captain received a wound at the diſtance of two fingers breadth from the navel by a ſword, which penetrated upwards and backwards: as the wound did not penetrate the cavity of the abdomen, it was only covered with a ſingle and flat pledgit and a plaiſter, ſo that on the next day it was cloſed. The abdomen was wonderfully painful and ſwelled for ſix days afterwards; but by the uſe of phlebotomy and the application of emollient fomentations to the abdomen, the pain was abated, and the next day a ſmall prominent tumour appeared in the place of the wound, which being opened, diſcharged an incredible quantity of matter, and was perfectly cured in the ſpace of eight days[b]. In another wounded patient, the ſword entered the epigaſtrium at the diſtance of two fingers breadth from the linea alba: and as the ſword was flat and eaſily flexible without breaking, it went according to the courſe of the ribs quite to the vertebræ of the back, from whence a fiſtulous ulcer was formed, the bottom of which being opened, a happy cure followed[c].

[a] Obſerv. Medic. Lib. III. cap. 28. pag. 230, 231.
[b] Traité complet de Chirurgie, par Mr. de la Motte, Tom. III. pag. 97.
[c] Ibid. 108—113.

SECT.

SECT. CCCVIII.

THerefore in theſe wounds recourſe muſt be had to ſuture and bandage: and then in other reſpects, the treatment uſual in common wounds will ſuffice.

What has been ſaid of the cure of wounds in general is applicable to theſe, and will be ſufficient for the cure, if there is no danger of ruptures or fiſtulæ. Narrow and deep wounds of the integuments eaſily degenerate into fiſtulæ; and therefore care muſt be taken by an artificial preſſure and a proper poſture of the patient to prevent the confined humours from forming ſinuſes in the panniculus adipoſus. But the broader ſort of wounds in the integuments very much endanger ruptures, whence it will be proper to unite them by ſuture, (ſee § 214.) and to ſecure the weakened part by an artificial application of compreſſes and bandages, that the contents of the abdomen being preſſed there may not dilate the peritonæum. But ſince every ſtrong effort in reſpiration is here very pernicious, therefore every thing which occaſions the perſon to breathe ſtronger than uſual ought to be ſtudiouſly avoided: and more eſpecially care muſt be taken not to retain inſpired air by ſhutting the larynx, as is done for example in diſcharging the fœces of the inteſtines, eſpecially when a ſtrong effort is required to expel the indurated fœces. Therefore the bowels are to be cleanſed with an emollient clyſter, and then the diet ought to be of ſuch food as affords the leaſt quantity of groſs fœces to be collected in the inteſtines; ſuch, for example, is the broth of fleſh, with which alone life may be ſupported, and yet the patient may without damage continue a month without going to ſtool, becauſe there are ſcarce any fœces thence accumulated in the inteſtines. For the ſame

reaſon the urine ought alſo to be retained for a conſiderable time, that it may be diſcharged almoſt ſpontaneouſly and with little or no ſtraining. If any cough ſhould attend, that muſt be appeaſed with diacodiates: laughing, calling out aloud, ſneezing, and the like, are to be avoided as much as poſſible: and for the ſame reaſon abſolute reſt ought to be ordered to the patient.

SECT. CCCIX.

BUT that ſuch a wound penetrates into the cavity of the abdomen will appear, 1. by the probe, and poſture of the patient: 2. by injections: 3. by a knowledge of the wounding inſtrument and nature of the wound: 4. by the egreſs of the contained parts.

We have already treated of the ſigns compriſed in the three former numbers of this aphoriſm, at § 306, and § 300. numb. 1, 2, 4.

4. If thoſe parts which we know are contained in the cavity of the abdomen come out through the wound, no doubt can then remain, but the wound has certainly penetrated into the cavity of the abdomen. But more eſpecially the omentum and inteſtines fall out, when the abdomen is perforated. It is eaſy to diſcover when the inteſtines are prolapſed, but in corpulent people, the fat being free from the preſſure of the divided ſkin, often protuberates through the mouth of the wound, and reſembles the fat of the omentum, which may occaſion an error in the diagnoſis of a wound. At the ſame time alſo a wound penetrating into the cavity of the abdomen may be ſo obſtructed or cloſed by this protruſion of the fat, that neither the probe nor the injection of warm water can diſcover that it penetrates. If in ſuch a wound there is a diſcharge of any of the humours belonging

to

to the abdominal viſcera, as blood, urine, bile, &c. of which we ſhall treat in § 312. this is an evident ſign, that the wound not only penetrates the cavity of the abdomen, but has alſo injured ſome of the parts therein contained.

SECT. CCCX.

BUT if all the ſymptoms are ſlight, without pain, fever, or inflammation, no blood comes from the wound when the patient lies upon it, and the injected liquor returns unaltered in its colour, we then know that the internal parts are not injured.

After the ſigns make it evident, that the wound has penetrated into the cavity of the abdomen, the next enquiry muſt be, whether or no any of the viſcera or veſſels contained in that cavity have received any injury. But ſince all the viſcera conduce to health by their functions, it will immediately appear, that if no great diſturbance of the functions can be obſerved depending on the continuity of thoſe viſcera, that no part of any moment is injured in the abdomen. And as the abdominal viſcera are principally ſubſervient to chylification, therefore if the retention and converſion of the aliments into chyle, the abſorption of that, and the expulſion of the remaining fœces, are performed as they uſually were in health, we may be certain that the wounding inſtrument has not injured any of the abdominal viſcera notwithſtanding its having penetrated into the cavity of the abdomen. But as the organs, which ſerve for the ſeparation and diſcharge of the urine and to generation, are (with ſome impropriety, becauſe ſeated without ſide the peritonæum) ſaid to be ſeated in the abdomen; therefore enquiry muſt be made, whether

any

any of the ſymptoms conſequent on the wound demonſtrate that theſe parts are injured.

Beſides theſe injuries of the abdominal viſcera, it ſometimes happens, that barely a diviſion of the nerves in the meſentery produces the moſt dangerous ſymptoms, and even death, as we obſerved from Ruyſch in the comment on § 170. numb. 3. but in that caſe the intenſe pain, fever, and inflammation, ſufficiently declare the danger that is preſent. Therefore if theſe ſymptoms are abſent, there is all the reaſon imaginable to expect a happy cure. But alſo the large veſſels, which convey blood, chyle, and lymph, may be injured by wounds in the abdomen; and therefore if the patient lies upon the wound, ſufficiently large or open, and no blood or other juice is diſcharged, we thence know that thoſe veſſels are not injured; but as extravaſated blood may congeal, and remain in the cavity of the abdomen without running out through the wound, therefore the ſurgeon injects warm water with a ſyringe at the mouth of the wound, which returning unaltered, nothing of this nature can be feared. But it muſt be remarked, that in an healthy living perſon the cavity of the abdomen is always full of moiſt vapours, which appear very manifeſtly upon opening the belly of an animal juſt killed: and theſe being condenſed by the cold of the air admitted, or by any other cauſe, may flow from the wound in form of a condenſed and collected lymph, though none of the internal veſſels are injured.

SECT. CCCXI.

THE air muſt be immediately excluded, and that which entered muſt be expelled by ſucking and the effort of expiration; the integuments are then to be ſewed together by the operation termed gaſtroraphia, laying aſide the uſe of tents; and thus the cure of the wound will

will be compleated by dreſſing ſeldom and with vulnerary balſams, and by the patient's lying upon the wound, keeping to a ſpare, moiſt, and healing diet, with reſt of body.

The air muſt be excluded, &c.] When it appears from the ſigns before deſcribed, that none of the contained parts in the abdomen are injured, ſuch a wound then requires to be immediately healed up. But it is to be obſerved, that the air will ſometimes enter through the wound, and being retained in the cavity of the abdomen, it may be there greatly rarified and expanded by the heat, ſo as to compreſs all the viſcera, if it be hindered from eſcaping again through the wound. Now from this air inſinuating itſelf into the panniculus adipoſus may ariſe wonderful emphyſemata, as we obſerved in wounds of the thorax at § 300. numb. 5. Therefore before the conſolidation or cloſing of ſuch a wound is attempted, one ought to be ſatisfied, that no air remains in the cavity of the abdomen: and if there is any there, it muſt be firſt diſcharged in the manner we directed in § 304. namely, by letting the patient retain the inſpired air as long as he well can, and then to make a ſtrong effort of expiration while the larynx is ſhut: for thus the contents of the abdomen will be ſtrongly compreſſed by the deſcent of the diaphragm and contraction of the abdominal muſcles during the niſus of expiration, and thus the confined air will be expelled through the mouth of the wound. But to prevent the omentum or inteſtines from being forced out at the ſame time, the wound may be covered with a piece of open linen, which will tranſmit the air and reſtrain the other parts from coming out.

The air being thus excluded, it is then required, by the general indications for the cure of all wounds (§ 185. numb. 3.) to unite again the parts which have been ſeparated by the wounding inſtrument, and to retain

retain them in that union; and this is performed in wounds penetrating the cavity of the abdomen by a particular method, namely,

By ſewing together the integuments.] This operation has been long ago deſcribed by the antients, who ſeem to have attempted it different ways. Galen [a] fearing leſt the divided lips of the peritonæum ſhould not conjoin with each other, becauſe he judged a membrane to be nervous and bloodleſs, would therefore have this operation performed ſo, that the divided lips of the peritonæum might unite with the oppoſite ſides of the wounded lips of the abdomen. For he orders the needle to be carried from without inwards through the ſkin without perforating the peritonæum, and then with the ſame needle he ſews the peritonæum, with all its incumbent integuments, to the oppoſite ſide of the wound; which done, he afterwards paſſes the needle through the ſame ſide of the wound from without inwards, perforating the ſkin and muſcles again without touching the peritonæum; and then again, on the oppoſite ſide he perforates the peritonæum, and ſews it to all the incumbent integuments, by paſſing the needle from within outwards. By this method he endeavoured to cauſe the divided peritonæum to unite with the oppoſide ſide of the divided abdominal muſcles. But there is ſtill another method propoſed by Galen in the ſame place for performing the gaſtroraphia, by which the parts are united and conſolidated each with its fellow; *viz.* the peritonæum with the peritonæum, and the muſcles with the muſcles, *&c.* and which therefore ſeems to be the better method of the two. Celſus [b], in deſcribing this operation, orders it to be performed, ſo as to make the ſuture firſt upon the moſt internal membrane; and that being done, to paſs the ſame needle and thread through the ſkin, and to unite the lips of the wound by ſuture in the

[a] Meth. Med. Lib. VI. cap. 4. Charter. Tom. X. pag. 140, 141.
[b] Lib. VII. cap. 16. pag. 453.

ſame

ſame manner: for, ſays he, neither the ſuture of the ſkin, nor of the peritonæum, will be ſufficient alone, but both are neceſſary. He would alſo have the ſuture performed with two threads, and thicker than are uſual in other wounds; becauſe they may be more eaſily broke by the motion of the abdomen, and becauſe the parts here are not expoſed to ſo great an inflammation. In making this ſuture it is principally required to give the patient as little pain as poſſible, and to avoid injuring either the omentum or inteſtines; nor is there any danger of the ſuture being torn open by the continual motion of the abdomen. But ſince the ſkin of the abdomen is very tough and difficult to perforate, as all thoſe have experienced who have ſewed up the abdomen after it has been opened in dead bodies; therefore it is required to have the needles very ſharp pointed, and with cutting edges, extending to about a third part of the length of the needle, which is to be ſo far crooked, and the remainder ſtrait. The thread muſt be ſtrong, or elſe ſeveral times doubled, not twiſted together, but diſpoſed in the ſame plain, the extremities of which are to be paſſed through the eyes of two of the forementioned needles; and then the point of one needle, being concealed by the fleſh of the fore-finger, is to be cautiouſly conveyed under the peritonæum in the cavity of the abdomen to avoid injuring the omentum or inteſtines; then let the peritonæum and integuments be perforated, by paſſing the needle at about the diſtance of a finger's breadth from the edge of the wound. In the ſame manner let the oppoſite lip of the wound be perforated with the other needle, and the thread, being drawn through, is to be afterwards tied in a knot upon ſmall compreſſes firſt placed underneath for that purpoſe. In this manner is the ſuture to be repeated according as the length of the wound requires. What elſe is neceſſary to be obſerved in performing the operation of gaſtroraphia may

may be ſeen in Garengeot [c] and the other writers on operations; ſee alſo what has been ſaid in the commentary on § 214.

The uſe of tents is to be laid aſide.] For theſe are in this caſe pernicious, ſince the divided parts require to be united, which union will be always impeded by the interpoſition of any foreign body. But the pernicious conſequence of uſing tents in wounds of the abdomen has been ſhewn both from reaſon and experience by Belloſte [d].

By the patient's lying upon the wound, and dreſſing it with balſam, *&c.*] ſince the union of the lips of the wound requires them to be brought together by ſuture, their conſolidation may be procured barely by dreſſing with a ſmall quantity of ſome vulnerary balſam, or the application of a ſmall pledgit moiſtened with the like balſam, agreeable to what we obſerved under the cure of wounds in general § 204. But the poſture of the patient is required to be ſuch, that the matter and other extravaſated juices may have a natural tendency to be diſcharged from the wound, which muſt therefore be laid upon. Abſolute reſt is here required, becauſe motion of the body, coughing, laughing, ſneezing, or difficult going to ſtool, augments the force of reſpiration, ſo as to endanger a laceration of the ſuture; or at leaſt thoſe violent motions of the abdomen would diſtract the threads and irritate the conjoined parts, whence inflammation, pain, and their bad conſequences may follow. For thoſe reaſons alſo a moiſtening and mild diet is neceſſary to be taken in a ſmall quantity at a time, to avoid a repletion and diſtention of the ſtomach and abdomen; fleſh broths are principally recommended here as we obſerved in the commentary on § 308. If now neither pain, itching, nor inflammation, *etc.* follow, ſeldom dreſſing of the wound will haſten the

[c] Traité des Operations de Chirurgie, Tom. I. pag. 124, *&c.*
[d] Chirurgien d'Hôpital, Part. II. chap. 15. pag. 114, *&c.*

cure,

cure, as we ſaid before in the cure of wounds in general.

SECT. CCCXII.

BUT if the pain is acute, and there are ſigns of a fever or inflammation, or if the wound diſcharges blood, ichor, food, drink, or chyle; or elſe if it diſcharges matter, bile, urine, or fœces, with a ſtench; in theſe caſes, by conſidering the wounding inſtrument with the ſituation and nature of the wound, the paleneſs, inquietude, faintings, cold ſweats, and deficient pulſe in the patient; all theſe will indicate, that ſome, and which of the abdominal viſcera are injured.

Hitherto we have conſidered wounds of the abdomen, which either injure the common integuments only, the peritonæum remaining entire, or which penetrate into the cavity of the abdomen, but without injuring any of the contained viſcera or veſſels. We come now to thoſe ſigns, by which we know, that ſome of the contained parts of the abdomen are injured; and from which ſigns may be concluded what parts contained in the cavity of the abdomen have been wounded. But all theſe ſigns are either taken from the matters diſcharged through the wound, or elſe from the injured functions.

Acute pain.] This is a ſymptom highly to be ſuſpected in wounds of the abdomen, denoting, that ſome of the membranous or nervous parts are injured. But how dangerous injuries of theſe parts are, may appear from what has been ſaid in § 170. numb. 3. where it is evident from the obſervations of Ruyſch, that wounds inflicted on the meſentery, without injuring any other parts, have produced the moſt excruciating pains of the abdomen, and proved fatal within two or three days; it alſo appears very proba-

ble,

ble, that all theſe ſymptoms follow from the injured nerves in the meſentery. Celſus [b] enumerates among the ſigns of a wound in the liver, ſhooting pains extending to the throat, and very ſevere where the neck is joined to the ſcapula of the ſame ſide. In wounds of the kidneys he obſerves, that the pain deſcends to the groins and teſticles: and the parts of generation in the female being wounded, he ſays excite a pain in the groins and hips.

Fever.] Which if it does not ariſe from a diſturbance of the mind in the wounded patient, is always the conſequence either of ſevere pain or inflammation, which muſt be always very dangerous in theſe nervous parts, as the meſentery, inteſtines, &c.

Inflammation.] The ſigns of which are, a ſhivering, and the feveriſh heat which follows, with thirſt, anguiſh, difficult reſpiration, a hard pulſe, dry tongue, &c. But how fatal an inflammation is in moſt of the abdominal viſcera, we are taught by the iliac paſſion and hernia incarcerata, in which diſeaſes even the moſt robuſt people periſh in a few hours time.

Blood.] Which denotes that ſome of the larger blood veſſels are injured, and that it is arterial, if it is diſcharged impetuouſly and of a very florid colour; but venal, if it appears of a darker colour.

Ichor.] Such a thin liquor may be diſcharged from various parts injured by the wound penetrating the abdomen. There are here a great many lymphatic veſſels, which may diſcharge ſuch a juice; or if the pancreatic duct, porus hepaticus, or pelves of the kidneys are wounded, they may diſcharge an incredible quantity of ſuch an ichor into the cavity of the abdomen. Even the vapours, which repleniſh the cavity of the abdomen in an healthy animal, being diſcharged from the perſpiring veſſels, and condenſed by the cold of the air admitted through the wound, without being abſorbed again by the veins, will be here collected, and often diſcharged in a very conſi-

[b] Lib. V. cap. 26. pag. 286.

derable

derable quantity from the mouth of the wound, when none of the internal parts are injured.

Food and drink.] These denote that the ſtomach is injured; wounds of which are always dangerous, but not abſolutely mortal; as appears from what has been ſaid in the commentary on § 170. numb. 5. to which we may add the inſtance related in the miſcellanea curioſa [b], of a man, whoſe ſtomach being wounded, and the lips of the wound becoming callous, did not unite, but part of the food and drink were diſcharged through the opening of the wound during the ſpace of eleven years.

Chyle.] If this is diſcharged through the wound, it denotes, that the ſmall inteſtines are injured, or that the chyliferous ducts are wounded, in which latter caſe the colour of the chyle is much whiter, whereas the chyle of the ſmall inteſtines always appears more of a grey or aſh colour, and when the ſmall inteſtines are wounded near the ſtomach, where the bile mixes itſelf, the chyle appears then of a yellowiſh colour.

Bile.] Which denotes an injury either of the common or cyſtic duct, or of the duodenum wounded in or near that part where it receives the common duct; but more eſpecially a large quantity of bile is diſcharged from the cavity of the abdomen when the gall bladder itſelf is wounded. There is a very remarkable caſe of this nature related in the philoſophical tranſactions [c], of an officer, who received a wound penetrating the cavity of the abdomen, and entering the bottom of the gall bladder, without offering any conſiderable injury to the other adjacent parts. The ſymptoms which followed this wound were ſurprizing enough, for the abdomen was immediately diſtended, as if the patient had been afflicted with an aſcites or tympanites, nor did the ſwelling either increaſe or diminiſh till the patient's death, which happened a week after the infliction of the wound. There were

[b] Decad. 2. Ann. 5. pag. 2.
[c] N° 414. pag. 341. Abridgm. Tom. VII. pag. 571, 572.

no belchings, flatus, or rumbling noiſe, and the bowels continued ſtrictly conſtipated during the whole time, notwithſtanding ſtrong purges and clyſters were uſed. The patient had ſcarce any ſleep, even though opiates were given in a very conſiderable doſe. The wound appeared externally pale, flaccid, and without matter. The pulſe was ſtrong, equal, and ſlow, but the day before death it was ſometimes a little intermitting, and the patient's ſenſes continued even till death; a ſlight hiccup and nauſea attended the fifth day after the wound was inflicted. From this hiſtory it is evident, that a diſcharge of bile from a wound of the abdomen is a very bad ſign.

Matter.] Which denotes a ſuppuration made in the internal parts from the inflicted wound, unleſs perhaps the patient ſhould have had a purulent vomica before, which the wounding inſtrument has now opened.

Urine.] Which being diſcharged from the wound, ſignifies, that the pelvis, ureter, or bladder is injured, as any one may readily perceive.

Fœces or ſtench.] It appears from phyſiology, that the ingeſted aliments are by degrees ſo drained by the action of the ſtomach and ſmall inteſtines, (the more fluid parts being abſorbed by the bibulous mouths of the meſeraic and lacteal veſſels,) that towards the end of the inteſtinum ilium ſcarce any thing more than the inſoluble fœces remain, which ſlip into the inteſtinum cæcum, from whence they are by degrees protruded through the whole length of the colon to the rectum, where they make their exit. Now it has been obſerved, that no ſtench (which is the ſign of incipient putrefaction) is perceptible in thoſe relicts of the chyle, unleſs in the cæcum, colon, and rectum; but never in the ſmall inteſtines. For this reaſon Helmont [d] ſays, *ſedere ſtercoreum fermentum, corruptionis opus, non nutritionis*; "that a ſtercoraceous fer-" ment is ſeated in the inteſtinum cæcum, not for

[d] Ortus midicin. pag. 179. n. 81, in fine capituli: *Sextuplex digeſtio alimenti humani.*

" the

" the buſineſs of nutrition but putrefaction." When therefore the fœces are diſcharged through the wound, or when their fœtid ſmell is expired through the wound, we may conclude that the large inteſtines are injured. Hence Celſus [e], after ſaying that a wound in the ſtomach and ſmall inteſtines have the ſame ſigns, he adds, *cætera inteſtina icta vel ſtercus, vel ejus odorem exhibeat*; " that the other inteſtines being wound-" ed, either diſcharge the fœces or their ſmell.

The wounding inſtrument, with the nature and ſeat of the wound.] If the inſtrument can be obtained with which the wound was inflicted, by comparing it with the width of the wound, it will often indicate how far the wound has penetrated: It is alſo evident, that the nature of the inflicted wound varies much according to the different direction in which the wounding inſtrument entered the cavity of the abdomen, either upward, downward, laterally, *etc.* alſo the ſituation of the abdomen and viſcera may differ much according to the different poſture of body which the patient was in at the time when he received the wound, and alſo according to other different circumſtances. Thus the very accurate anatomiſt, Winſlow, has obſerved [f], that the liver in the human body is ſo firmly attached by its ligaments, that it cannot eaſily ſlip from one ſide to the other; yet that it is not abſolutely ſuſpended by them, but is in part ſuſtained by the ſtomach and inteſtines, eſpecially when they are full. Hence after long faſting, the liver deſcending by its own weight, pulls down the diaphragm, and occaſions an uneaſy ſenſation, which the ſame anatomiſt thinks is unjuſtly aſcribed to the ſtomach. Therefore if a man be wounded when the ſtomach is empty and in an erect poſture, at the diſtance of about two fingers breadth under the falſe ribs on the right ſide, in that caſe the liver may be injured, as it deſcends below the margin of the ribs; and of this na-

[e] Lib. V. cap. 26. pag. 287. [f] Expoſition Anatomique, &c. Traité du bas ventre, n° 267, 268. pag. 350.

ture we have an inſtance related by Garengeot [a] of a man who died of ſuch a wound, upon opening whoſe body an abſceſs appeared in the liver from this cauſe. The ſame is alſo true of the ſtomach, which when full frequently deſcends to a conſiderable degree.

Paleneſs, cold ſweat, inquietude, fainting, and deficient pulſe.] All theſe ſigns denote a deficiency in the vital powers, and generally follow a great loſs of blood; therefore when theſe ſigns appear without any flux of blood externally from the wound, we ought then to think of an internal hæmorrhage, and conclude that the large blood-veſſels are injured: for the blood being thus extravaſated within the cavity of the abdomen, returns only in a ſmall quantity to the heart, whoſe force will be therefore diminiſhed, whence the pulſe begins to weaken, intermit, and at length wholly ceaſes in a perfect ſyncope. Hence paleneſs from a collapſion of the empty blood-veſſels, and a cold ſweat, which are certain marks of weakneſs in the vital powers. Then begins that ſtruggle of life with death which is commonly called an agony, namely, extreme anguiſh and inquietude, ſo that they are continually changing the poſture of their body ſo long as their ſtrength will permit, and at length a deliquium or death itſelf follows. Conſult what has been ſaid in the commentary on § 302. numb. 7.

Sometimes perhaps theſe ſymptoms may ariſe from an injury of the nerves, which are diſperſed through the viſcera of the abdomen. For that theſe nerves have a very great influence upon the vital functions, we are taught by ſudden deaths which follow from the inverſion of an inteſtine, or incarcerated rupture, *etc.* even in the moſt healthy and robuſt people; in which diſorders all theſe ſymptoms appear, and are often followed with death in a few hours. Hence Celſus [b], enumerating the ſigns of a wound in the

[a] Traité des Operations de Chirurgie, Tom. I. pag. 84.
[b] Lib. V. cap. 26. pag. 287.

ſtomach,

ſtomach, ſays, *Venarum motus elangueſcunt, ſudores tenues oriuntur, per quos extremæ partes frigeſcunt*; "That the pulſe languiſhes, and thin ſweats ariſe, in "which the extremities grow cold." And immediately afterwards he adds, that the ſigns of a wound in the ſtomach and inteſtines are the ſame.

From all theſe ſigns we know, that the parts contained in the cavity of the abdomen are injured, and frequently it is ſufficiently evident from the ſame ſigns, which of the contained parts are affected; ſo that from hence we have a diagnoſis of theſe wounds, and in the following aphoriſm we are taught their prognoſis.

SECT. CCCXIII.

THEN follow an infinite number of diſorders, partly 1. from the nature of the viſcera, which are not muſcular, but compoſed of thin veſſels, in which the circulation is difficultly performed, and not unleſs the abdomen be entire; 2. from an injury of the function of the viſcus; 3. from the quantity and putrefaction of the extravaſated blood; 4. from the preſſure, rarefaction, and injury received from the air, which has entered through the wound.

1. It appears from phyſiology, that all the abdominal viſcera, which are ſubſervient to chylification, tranſmit all their venal blood to the ſinus of the vena portæ, which immediately after divides and diſtributes all the received blood throughout the whole maſs of the liver in ſuch a manner, that the blood no longer flows from ſmall to larger branches, but from a broad baſis to a narrower, as in the arteries. Hence it is evident that the circulation of the juices muſt be here very difficult, ſince the venal blood having loſt the greateſt part of its motion, which it re-

ceived from the heart and arteries, is here again obliged to paſs through the narrow and converging veſſels of the liver. But then this circulation of the juices is promoted by the action of the diaphragm and abdominal muſcles, which preſs alternately upon all the abdominal viſcera: for at the time of inſpiration the diaphragm deſcends downward, and diminiſhes the cavity of the abdomen compreſſing all the contained parts, but at the time of expiration the muſcles of the abdomen contract and re-act in the ſame manner upon the viſcera. Hence the circulation of the blood is promoted through the abdominal viſcera every moment of life by theſe alternate preſſures, and from hence ſo frequently ariſe obſtinate obſtructions about the liver, ſpleen, and other viſcera of the abdomen, in ſuch people as, leading a ſedentary and unactive life, neglect the healthy exerciſes of body, and from whence follow many of the moſt obſtinate chronical diſorders. When therefore this action of the diaphragm and abdominal muſcles is diſturbed or removed by a wound, it is evident, that this preſſure will be wanting, which is required to promote the circulation of the juices through the abdominal viſcera. This appears evidently in the diſſection of living animals; for when the abdominal muſcles are divided by tranſverſe inciſion, all the veins of the abdominal viſcera will in a few minutes time appear very much diſtended, becauſe the venal blood cannot obtain a free courſe through the ſmall veſſels of the liver for want of this action of the abdominal muſcles. In the mean time it is very evident, that this bad conſequence is not to be expected from all wounds of the abdomen, but only from thoſe which conſiderably injure the action of the diaphragm or abdominal muſcles. Add to this, that the air ruſhing in through large wounds, may by the coldneſs of it, to which the abdominal viſcera are unaccuſtomed, very much injure them, and from theſe two cauſes may be deduced

duced the reaſon why the omentum or inteſtines ſo eaſily mortify when they prolapſe through a wound.

2. Each of theſe viſcera have their particular uſes ſubſervient to the buſineſs of chylification, and therefore an injury offered to one or more of them will diſturb the formation of the chyle. Thus for example, if one of the ſmall inteſtines be divided near the pylorus all the chyle will eſcape into the cavity of the abdomen, or be diſcharged through the wound, the body will be defrauded of its nouriſhment, and the patient will periſh by a true maraſmus. A wound of the gall bladder will extravaſate that important juice into the cavity of the abdomen, as in the caſe we related under the preceding aphoriſm, whence the bowels will remain obſtinately bound up, without being relieved by any medicines, accompanied with a ſudden and laſting inflation of the abdomen, which are conſequences that one would not eaſily foreſee to happen from ſuch a wound. Hence it is alſo evident, how neceſſary the action of the bile is towards that of moſt of the abdominal viſcera. But the bile is formed from the venal blood coming from all the chylificative viſcera, and perhaps of a different nature in each, being alſo wonderfully changed by the ſtructure of the liver itſelf; whence an injury of the abdominal viſcera frequently deſtroys ſomething neceſſary to the ſecretion of good bile; and the bile therefore degenerating from its healty or natural ſtate, the formation of the chile may be wonderfully diſturbed. Thus the liver and ſpleen appear like a ſponge full of blood, and therefore a quantity of blood being extravaſated from a wound in either of theſe may produce inflammation, ſuppuration, or a converſion of thoſe viſcera into corrupt matter, *&c.* as one may reaſonably expect.

3. A diviſion of the blood-veſſels, which are diſtributed in ſuch numerous and large branches through the viſcera of the abdomen, may evidently extravaſate a large quantity of blood into the cavity of the

abdomen, where it may be injurious by its weight compreſſing the viſcera, and alſo by its putrefaction, eſpecially if the air is alſo freely admitted at the ſame time. But a ſmall quantity of extravaſated blood, without any conſiderable injury of the important viſcera, is not judged very dangerous by Ruyſch[a], who made experiments of this kind on living animals, eſpecially if the free acceſs of the air is prevented; for that anatomiſt having firſt tied the ſplenic veſſels in a dog of a moderate ſize, he afterwards cut out the ſpleen, but neglected to tie up the ſmall epiploic artery, which diſcharged ſo large a quantity of blood, that the dog ſeemed as if he would ſhortly expire. He nevertheleſs protruded the artery without ligature into the abdomen, where it doubtleſs continued to bleed; he then united the wound of the abdomen by ſuture, and the dog afterwards did well, the wound healing in ſix or ſeven days time. From this experiment he concludes, that blood extravaſated into the cavity of the abdomen, may be again abſorbed; without any bad conſequence following, provided the air is excluded.

4. If air enters through the wound into the cavity of the abdomen, and the orifice of the wound is in the mean time obſtructed by the fat or any other cauſe, ſo as to prevent the air from eſcaping again, it may be rarified by the heat of the body, and diſtend the abdomen to an immenſe bulk: but at the ſame time it will compreſs all the viſcera contained in the abdomen, more eſpecially the ſtomach and inteſtines, which it may preſs quite flat; whence may follow miſerable conſequences, which can only be remedied by diſcharging the rarified air.

[a] Obſervat. Anatom. Chirurg. 66.

SECT.

SECT. CCCXIV.

FROM hence theſe wounds are often mortal. But large wounds of the inteſtines which are acceſſible to the hand, muſt be conjoined by ſuture; or if the inteſtines are injured with ſmall wounds, they may be left to themſelves, and the remainder of the treatment be performed as we directed at (311.)

From all that has been ſaid it is evident, what a great diverſity there is in wounds penetrating the cavity of the abdomen, and injuring the contained viſcera or veſſels. If now we conſider what has been already ſaid concerning the mortality of wounds in general, § 170. numb. 3, and 5, together with the wonderful diſorders which have been obſerved to follow an injury of the diaphragm, of which we treated in the ſame ſection at numb. 4. it will eaſily appear that inevitable death muſt be frequently the conſequence of wounds in the abdomen.

We come now to conſider what ought to be done in the cure of wounds in the abdomen, when the inteſtines are injured, and are acceſſible to the hand. Hippocrates [a] has pronounced wounds of the ſmall inteſtines to be mortal; but Galen, in his commentaries, will not have every kind of wound in the ſmall inteſtines mortal, but only ſuch as penetrate into their cavity; and theſe, he ſays, are very rarely cured. In another aphoriſm Hippocrates [b] ſays, that one of the ſmall inteſtines being divided, it will not unite. Celſus likewiſe affirms, [c] *Si tenuius inteſtinum perforatum eſt, nihil profici poſſe. Latius inteſtinum ſui poteſt: non quod circa fiducia ſit, ſed quod dubia ſpes certa deſpera-*

[a] Aphor. 18. Sect. VI. Charter. Tom. IX. pag. 257.
[b] Ibid. 24. Sect. VI. pag. 261.
[c] Lib. VII. cap. 16.

tione

tione ſit potior: interdum enim glutinatur: "If one of "the ſmaller inteſtines is perforated, no good can be "done. But one of the larger inteſtines may be con- "joined by ſuture: not that the cure will certainly "follow by that means, but becauſe a doubtful re- "medy is better in a deſperate caſe than none at all; "for ſometimes it is healed."

But it appears at preſent from a great many faithful obſervations, that the ſmall inteſtines have been entirely divided, and yet the wounded patient has afterwards recovered. If therefore the inteſtines are injured with a ſmall wound, not ſufficient to let the contents into the cavity of the abdomen, they may be left to themſelves, for in that caſe the cure eaſily ſucceeds ſpontaneouſly. For ſo ſoon as the inteſtines have prolapſed through the wound, they are uſually greatly diſtended with flatus, if they are entire; and they then appear very thin and membranous: but if we conſider them in their natural ſtate, they appear ſufficiently thick and compact, ſo that a ſmall wound cannot much injure them. It is evident from the inſtance of the madman, which we mentioned in § 170. numb. 5. who inflicted eighteen wounds in his own belly; it is thence evident, that ſuch wounds of the ſmall inteſtines may heal ſpontaneouſly, as we are taught by the cicatrices of the healed wounds, which appeared in the body after death. When the ſmall inteſtines of a dog are cut open longitudinally, as we mentioned in the ſame place, upon returning them into the abdomen without any ſuture, the animal afterwards recovered. And obſervations teach us, that even pretty large wounds of the inteſtines have been cured ſpontaneouſly, though they were ſufficient to let out the contents. A man was wounded with a large bullet, which perforated the cavity of the abdomen, and entered the inteſtinum colon, with conſiderable injury, inſomuch, that for the ſpace of two months time, the fœces were diſcharged through the wound; but at length the wound healed without any aſſiſtance from

from art, and the man perfectly recovered. [d] An eminent cook was wounded in the abdomen with a knife, ſo that the edge penetrated the larger inteſtine or colon, on the right ſide; and though it hung out of the body for above the ſpace of thirty hours, and was very much injured by the cold, yet it was returned again into its place without any bad conſequence. The inteſtinal fœces were diſcharged daily through the mouth of the wound, and though the abandoned glutton obſerved no regimen of diet, yet the wound of the inteſtine was happily conſolidated, as appeared in the dead body, ſix years after the wound was inflicted.

But when wounds inflicted on the inteſtines are ſo large, that there is reaſon to fear their contents will eſcape into the cavity of the abdomen, where, being accumulated and putrefied, they may corrupt all the adjacent parts; in this caſe, if the wound of the inteſtine is acceſſible to the hand, it will be proper to make the ſuture. In theſe caſes ſurgeons generally uſe what they call the glover's ſuture, becauſe the ſkins of animals being lacerated, are uſually mended by the dreſſer with this kind of ſuture. This ſuture is performed upon the inteſtine by perforating both the divided lips at the ſame time, with a needle armed with a flat ſilken thread; then the ſecond ſtitch is made as before, at about the diſtance of two lines from the firſt, always beginning at one and the ſame ſide of the inteſtine, and repeating it till the lips of the wound are contiguous; thus will the divided lips of the inteſtine be retained in contact, by a ſpiral circumvolution of the thread, a pretty long piece of which is to be left pendulous out of the wound, that the conjoined inteſtine may be afterwards eaſily extracted. On this account the ſtitches are to be made at larger diſtances, and the ends of the thread are not to be continuous with the ſpiral circumvolutions,

[d] Belloſte Chirurgien d'Hôpital, pag. 266. part. 3. chapit. 15.
[e] Tulpii Obſervat. Medicar. Lib. III. cap. 20. part. 212.

which

which retain the lips of the inteſtine, as many authors direct: for then the threads cannot be drawn out of the wound without wrinkling the ſuture of the inteſtine, which will produce acute pain, inflammation, gangrene, *etc.* Upon this ſuture conſult Garengeot[f], who has given the beſt deſcription of the method of performing it.

It is very apparent, that this ſuture ought not to be performed but in caſe of urgent neceſſity, ſince it requires the inteſtine to be drawn out of the abdomen, and to be roughly handled for a conſiderable time, in the cold air; from whence fatal conſequences have been obſerved to follow by ſeveral authors. But the inſtances which we alledged in the commentary on § 170. numb. 5, where the ſtomach itſelf, divided by a wound, was conjoined by ſuture; and the inſtances which we ſhall hereafter produce in the commentary on § 317; ſufficiently prove that this operation ought not to be condemned as uſeleſs or pernicious.

SECT. CCCXV.

If the inteſtine comes out ininjured through a large wound of the abdomen, let it be fomented by the application of live animals ſlit open, or with a proper fomentation, until it is replaced, and let the reſt of the treatment be performed as in (311.)

So long as the inteſtines remain in the abdomen, they are on all ſides moiſtened with warm vapours, and lubricated with a ſubtile oil, as we may be convinced barely from touching them in the diſſection of living animals. Therefore when the inteſtines prolapſe through a wound of the abdomen, being deprived of their moiſt and warm vapours, they ſoon become

[f] Traité des Operations de Chirurgie, Tom. 1. pag. 105, &c.

become cold, dry, and often ſpeedily tend to mortification; which we know chiefly by their change of colour. Celſus [a] has beautifully expreſſed himſelf upon this ſubject, when he ſays, *Protinus conſiderandum eſt, an integra ea ſint; deinde, an his color ſuus maneat, etc. Tum, ſi utrumlibet inteſtinum (craſſum nempe et tenue) lividum, aut palidum, aut nigrum eſt; quibus illud quoque neceſſario accedit, ut ſenſu careat, medicina omnis inanis eſt. Si vero ea adhuc ſui coloris ſunt, cum magna feſtinatione ſuccurrendum eſt: momento enim alienantur, externo et inſueto ſpiritu circumdata:* "It muſt "be directly conſidered whether the inteſtines are "ſound, or whether they retain their colour, *etc.* "Then if either of the inteſtines, whether large, or "ſmall, appears livid, pale or black, and without "ſenſe, which is a neceſſary attendant of theſe "changes in colour, all remedies are then ineffectual. "But if the inteſtines as yet retain their colour, aſ-"ſiſtance muſt be very ſpeedily given; for they are "ſoon changed by the unuſual contact of the ambi-"ent air." And that Celſus well underſtood that the inteſtines are naturally moiſtened, not only with a thin lymph, but alſo with a fat oil, is very apparent; becauſe he ſoon after adds, [b] *Ac, ſi jam ſicciora ſunt inteſtina, perluenda aqua ſunt, cui paululum admodum olei ſit adjectum:* "But if the inteſtines appear drier "than they ought to be, they are to be fomented "with water, to which a little oil is to be added." When therefore the gyri of the inteſtines prolapſe through a large wound, they are to be immediately replaced, if they are not yet become cold or dry. The retaining of the inteſtines will be much facilitated, if the patient is placed in ſuch a poſture, that the contents of the abdomen cannot preſs upon the part wounded by their own weight; and therefore Celſus [c] would have the patient laid upon his back, with his hips raiſed. For in that poſture the viſcera,

[a] A. Corn. Celſi Medicin. Lib. VII. cap. 26. pag. 452.
[b] Ibidem. [c] Ibidem.

contained

contained in the cavity of the abdomen, preſs the diaphragm into the cavity of the thorax; by which means the capacity of the abdomen is increaſed, ſo that the prolapſed inteſtines may be more eaſily replaced. In this reduction of the inteſtines, [d] Celſus again very well adviſes, *Quod Medicus priora ſemper inteſtina, quæ poſteriora prolapſa ſunt, condere debet ſic, ut orbium ſingulorum locum ſervet. Repoſitis omnibus leniter homo concutiendus eſt, quo fit, ut per ſe ſingula inteſtina in ſuas ſedes reducantur, et in his conſidant:* "That the ſurgeon ſhould always operate ſo as to re-"turn thoſe inteſtines firſt which prolapſed laſt, that "each of their gyri may keep its place. After they "are all replaced, the perſon is to be gently ſhook, "that each of the inteſtines may reduce itſelf to its "proper place, and there remain." For unleſs this be obſerved, violent gripes and many other bad conſequences may follow.

Another admonition, of no ſmall importance, is given us by [e] Garengeot: namely, that if the wound is in the middle of the abdomen, under the navel, penetrating through the rectus muſcle, on either ſide, then the prolapſed part of the inteſtine or omentum is frequently liable to be returned under that muſcle, betwixt its body and the tendinous capſule, which very looſely encompaſſes this muſcle below the navel; ſince it might be thus falſly imagined, that the inteſtine is returned into the abdomen. It is ſufficiently evident, that the very worſt conſequences muſt follow from ſuch an error; namely, inflammation, pain, *etc.* in the inteſtine, thus violently compreſſed by the incumbent muſcle.

But when the prolapſed inte ſtinesare already cold, or dried by the air, it will then be beſt to foment and moiſten them before their reduction; for which purpoſe nothing better can be contrived, than the application of the inteſtines of a healthy living animal,

[d] Ibidem, pag. 453.
[e] Traité des Operations de Chirurgie, Tom. I. pag. 102.

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immediately after opening its belly; for then they are warmed and moiſtened in a manner with their natural foment. Hence this method is often the only relief that can be had in the iliac paſſion, and in the reduction of incarcerated ruptures. If living animals are not at hand for this uſe, warm milk and water, with a little oil, or fat mutton broth, boiled with emollient herbs, may be uſed for the ſame purpoſe, if they are always applied of a due warmth. It is indeed true, that upon returning the prolapſed and cold inteſtines into the cavity of the abdomen, they will be there warmed and moiſtened; but we ought firſt to be certain, that life ſtill remains in the cold and ſenſeleſs parts, before they are replaced, or elſe we may expect an abſolute mortification, if they are already begun to be gangrenous; and though a ſeparation of the corrupted parts ſhould ſucceed there, the contents of the inteſtines would nevertheleſs eſcape into the cavity of the abdomen, whence the death of the patient would follow, after ſuffering the moſt miſerable diſorders.

SECT. CCCXVI.

IF the inteſtine, coming through a ſmall wound of the abdomen, cannot be reduced, either from its inflammation, diſtention with wind or fœces; let it be returned by the uſe of fomentations, by puncturing, or by dilating the wound.

When the abdomen is perforated with a large wound, the inteſtines eaſily prolapſe; but then there is alſo no great difficulty in replacing them: but when part of an inteſtine has been forced through a narrow wound, the diſorder is much more dangerous. For the prolapſed inteſtine being compreſſed by the margin of the wound, will ſoon be diſtended with flatus

flatus, or the ingeſted aliments, drove thither by the periſtaltic motion; whence the inteſtine will be inflamed, tumified, and incapable of being returned through the ſtricture of the wound; whence a ſtoppage of the circulation and a gangrene ſoon follow, as hath frequently been obſerved in incarcerated ruptures. It is very evident, that in this caſe the inteſtine cannot be reduced, unleſs the diſtention of it be firſt diminiſhed, or the wound dilated; the former of which ought always to be firſt attempted, ſince the dilatation of the wound cannot be performed without pain and danger. Thoſe fomentations may be therefore applied warm, which are directed under the preceding aphoriſm; and then it may be gently attempted by the hand, to propel the flatus or other contents through the wound, into the common tract of the inteſtine, by which means the tumor may ſubſide, and the inteſtine may be reduced. But if it ſhould continue diſtended with flatus, and fomentations have been uſed for ſome hours without effect, the diſtended part of the inteſtine may be then punctured with a needle in ſeveral places, to diſcharge the flatus. Nor is there any danger to be feared from theſe ſmall wounds; for the flatus being diſcharged, the inteſtine will contract, and the ſmall openings made by puncture will diſappear; nor will they permit any of the inteſtinal contents to eſcape. [a] Parey tells us, that he has ſucceſsfully uſed this puncturation of the inteſtine. But to prevent the ignorant from blaming or reflecting upon this method of perforating the inteſtine, it is beſt to perform it privately, as it may be done without difficulty. For the fatal event of ſuch a wound might be ſometimes aſcribed to the ſurgeon, though he does no more in the caſe than what art evidently requires.

But if neither this method ſucceeds, a dilatation of the wound then only remains; which Celſus [b] has alſo

[a] Livre X. Chapitre 36. pag. 256.
[b] A. Corn. Celſ. Medic. Lib. VII. cap. 16.

recom-

recommended in this caſe, when he ſays, *Si anguſtius vulnus eſt, quam ut inteſtina commode refundantur, incidendum eſt, donec ſatis pateat:* "If the wound is narrower than will conveniently permit for returning the inteſtines, it muſt be ſufficiently enlarged by incision." But great caution is here evidently required, becauſe the prolapſed inteſtine, being very ſtrictly compreſſed by the wounded lips of the peritonæum and integuments, may therefore be eaſily injured. To avoid this, the ſurgeon introduces a grooved probe or director into the cavity of the abdomen, drawing the inteſtine a little back at the ſame time, when that is found neceſſary; and then, that he may be certain the inteſtine is not intercepted, betwixt the director and the margin of the wound, he draws the inteſtine a little more out; he then introduces his inciſion knife into the groove of the director, and carefully divides the peritonæum: this done, he then elevates the director and inciſion knife lodged in its ſulcus, and divides the integuments of the abdomen, till the wound appears ſufficiently large, for the commodious returning the inteſtine into the cavity of the abdomen. But if the ſtricture upon the prolapſed inteſtine is ſo great, that it is impoſſible to introduce the director, then the inteſtine is to be preſſed with the fleſhy part of the fore-finger, that it may recede a little from the margin of the wound; and then let the integuments and peritonæum be divided a little, upon the nail of the ſame finger, to make way for the introduction of the grooved probe or director.

To perform this operation with the greateſt ſafety, ſeveral uſeful inſtruments have been contrived by celebrated ſurgeons. Thus we are furniſhed with a director, which conceals an inciſion knife in its groove, that can be raiſed at the pleaſure of the ſurgeon, by preſſing upon a ſpring: the figure of which inſtrument may be ſeen in Heiſter's ſurgery[c]. Petit uſed

[c] Inſtitut. Chirurg. part II. cap. 114. tab. 24. pag. 797.

only a ſtreight inciſion knife, furniſhed with an obtuſe point, and with a very dull edge: this knife he introduced perpendicularly into the abdomen, without danger of injuring the viſcera; becauſe it had a globular point, and would not eaſily cut; yet the edge of the knife was ſharp enough to divide the very tenſe integuments of the abdomen[e]. The ſimplicity of this method has pleaſed many, but there are other ſurgeons who prefer the former inſtrument.

The wound being thus dilated, and the prolapſed inteſtine returned; all the reſt is to be conducted in the manner deſcribed at § 311.

SECT. CCCXVII.

If part of the inteſtinal tube is loſt either by a wound, ſuppuration, or gangrene, and the upper part of the inteſtine offers itſelf, or can be carefully drawn out, it ought then to be ſewed to the margin of the wound.

But if the inteſtine is entirely divided; or if prolapſing through a narrow wound, and not being returned in time, part of it ſhould be deſtroyed by a ſuppuration or gangrene; in that caſe the continuity of the inteſtinal tube is removed; and if the divided ends are returned into the cavity of the abdomen, it is very evident that the chyle of the inteſtines, being diſcharged into that cavity, accumulated and there putrefied, muſt produce a train of miſerable conſequences, and inevitable death itſelf. The ſame is alſo true, if the inteſtine be returned entire, but invaded in ſome part with a gangrene; for the diſeaſed part muſt then ſeparate, whence all the ſame maladies will follow. All that art can then perform, is, to attach the end of the divided inteſtine to the ex-

[e] Garengeot Traité des Operations de Chirurgie, Tom. I. pag. 119.

ternal

ternal margin of the wound; and thus a filthy drain will be there fixt during life, which will ſupply the place of the anus. Phyſicians and ſurgeons formerly had no hopes of this concretion of the divided inteſtine; being oppoſed by the authority of Hippocrates, who ſays, *Si inteſtinum tenue diſſecetur, non concreſcit*: "That if a ſmall inteſtine be divided, it "does not heal or unite." But we are taught by wonderful obſervations, that ſuch a concretion is not always to be deſpaired of. A ſtrong man had been afflicted with a rupture the ſpace of eight years, which however did not give him much trouble; but on a ſudden the hernia ſwelled with a conſiderable hardneſs, which the ſurgeons in vain attempted to remove, by the application of emollient cataplaſms. At length the tumour ſuppurated, and being opened, the ſurgeon amputated part of the inteſtine, which was putrefied to the length of four fingers breadth; afterwards a portion of the ſame length ſeparated ſpontaneouſly. When it was now believed by every body, that an opening would remain in this place, which would perform the office of an anus during the patient's life; yet beyond all expectation the diſcharge of humours from the wound grew leſs, and the patient was cured within the ſpace of thirty-three days, and lived afterwards perfectly in health [b]. We are ſtill more evidently taught by another caſe, that an inteſtine which has been totally divided may unite together. In a man afflicted with a rupture, part of the inteſtinal tube, to the length of ſix inches, was deſtroyed by a gangrene. A thread being paſſed through that part of the meſentery to which the corrupted inteſtine adhered, both ends of the inteſtine were by that means retained in the mouth of the wound, with a view that they might adhere to the margin of the wound, and that the upper end of the

[a] Aphoriſm. 24 Sect. VI. Charter. Tom. IX. pag. 261. & in Coacis Prænot. numb. 503.

[b] Academie des Sciences l'an. 1723. hiſt. pag. 41, &c.

inteſtine might perform the office of an anus, the other end remaining uſeleſs: but in a month's time the two ends ſo united, beyond all expectation, that the ingeſted aliments were diſcharged again, by their common courſe, through the anus; ſo that the man recovered, only with this inconvenience, that if he eat much, he was troubled with the colic, which began at the part wounded, and grew leſs upwards. This ſeems to have been the conſequence of a ſtricture in the inteſtinal tube, which was not only narrower, but of a more compact ſubſtance, and leſs able to yield, where the two ends were united[c]. This is alſo confirmed by another remarkable inſtance. Ramdohrius, ſurgeon to his Serene Highneſs the Duke of Brunſwick, removed a conſiderable part of the corrupted inteſtine, in a woman who had an incarcerated rupture, which broke ſpontaneouſly; he afterwards introduced the upper end of the inteſtine into the lower, and having conjoined them by a ſlight ſuture, replaced them into the abdomen. This woman being thus ſnatched from the jaws of death, lived afterwards in health; but being taken with a pleuriſy, ſhe expired in about a year from that time, and upon opening her body, the ends of the inteſtine appeared to have well united rogether. This inteſtine, together with part of the abdomen to which it adhered, is now kept by the celebrated Heiſter[d], to whom it was given as a preſent by an expert ſurgeon.

But it is very evident, that ſuch an union of the divided inteſtine will not follow, if the two ends are left fluctuating in the abdomen; but for this purpoſe it is required that they remain in contact with each other, by adhering to ſome adjacent part; and therefore this union more frequently happens in ruptures, becauſe the extremeties of the inteſtine, coming thro' the ring of the abdominal muſcles, folded together,

[c] Ibidem, pag. 44.
[d] Inſtitut. Chirurg. part. II. cap. 117. pag. 818.

remain

remain in contact with each other, as it is beautifully demonſtrated and illuſtrated with figures by the celebrated Morand[e], who has very reaſonably deduced the manner of concretion, and the other conſequences thence ariſing from the ſtructure of the parts. It is in the ſame place proved, that the capacity of the inteſtinal tube is always leſs in the part where it is joined, which the ſame author teſtifies he has frequently ſeen after death in the bodies of thoſe, who have been afflicted with theſe diſorders. On this account therefore, if the patient does not abſtain from the more compact food, and eat in ſmall quantities at a time, there will be danger of an obſtruction at the ſtricture, whence follow the moſt acute pains, and often a rupture of the part though long conjoined; of which we have an inſtance in a woman, who expired from this cauſe many years after ſhe had been perfectly cured, in whoſe abdomen both the ingeſted aliments and medicines were found diſcharged by a rupture of the inteſtine in that part, where its two divided ends had united[f].

But when there are no hopes that the divided ends of the inteſtinal tube can be united with each other, the only method that then remains is to conjoin the upper end of the inteſtine by ſuture to the margin of the external wound; where it ſometimes naturally tends, or is cautiouſly conducted by art, to ſerve as an artificial anus during life; while the other end, being tied with a ligature to prevent its preſent contents from eſcaping into the abdomen, remains ever afterwards uſeleſs. And in this manner may life be preſerved, if the length of the inteſtinal tube from the pylorus to the artificial anus be ſufficient to abſorb chyle enough from the ingeſted aliments to ſupply the blood, for repairing thoſe loſſes which are made in the ſubſtance of the body by the continual actions of life. But in order to know which of the two extremities

[e] Acad. des Sciences l'an. 1735. Mem. pag. 335, &c.
[f] Ibid. pag. 376.

belongs to the upper tract of the inteſtines continued to the pylorus, take the ſigns delivered by the celebrated Littre[g]: for the upper extremity will have an apparent vermicular motion, the matter of the chyle will paſs alternately through that extremity, the ſides of which will not appear entirely collapſed, or if they do ſometimes collapſe, they will be ſoon after elevated by the matter contained in the cavity of the inteſtine protruded there. But in the other end of the divided inteſtine, which is continued to the rectum, there will be no periſtaltic motion, nor any thing diſcharged from thence, unleſs in the beginning, or when ſomething is forced out by a convulſive and retrograde motion aſcending from below upwards; and which never follows ſo regularly, as it may be diſcerned in the upper extremity. That extremity being found which is continued to the duodenum, the ſurgeon then divides its circumference in three places, and unites it by ſuture to the margin of the wound; or elſe by paſſing threads through the end of the inteſtine, retains it in the mouth of the wound, till it there conjoins. Thus may life be preſerved by art, but not without a very foul inconvenience, ſince the fœces muſt paſs this way ſo long as the perſon lives. It ſometimes happens, that the upper extremity of the divided inteſtine conjoins with the mouth of the wound by the aſſiſtance of nature only. Thus M. Mery[h] cut off above five feet in length of a mortified inteſtine in a maid of twenty-eight years old, following an incarcerated rupture; and the upper orifice of the inteſtine adhered afterwards to the inguen, where the fœces were diſcharged during the remainder of life; and they were ſufficiently hard and figured, when ſhe took food of eaſy digeſtion and in moderate quantities. Many ſuch caſes have happened after a battle, when ſoldiers ruſh upon the enemy with their bayonets fixt upon their muſkets, whence frequently

[g] Acad. des Sciences l'an. 1700. Mem. pag. 394.
[h] Ibid. l'an 1701. pag. 372, 373.

follow

follow very bad wounds of the abdomen, attended with a diviſion of the inteſtines. I remember to have ſeen a ſoldier about twenty years ago, in whom the inteſtinum colon adhered to the external orifice of the wound after it had been divided in this manner; and as he begged alms, he readily permitted the inteſtine to be examined, which adhered with ſome part of it hanging out, ſo that one might very well examine the ſurface of the inteſtine. It was then ten years ſince he received the wound, and he ſeemed to enjoy a perfect ſtate of health.

SECT. CCCXVIII.

IF the omentum is prolapſed and appears as yet moiſt, warm, and reddiſh with the circulating blood, it is to be replaced as before (316.)

Hippocrates ſays [a], *ſi omentum excidat, neceſſe eſt putreſcere*; "That if the omentum prolapſes through "a wound, it muſt neceſſarily corrupt or mortify." Certain it is, that the tender fabrick of the omentum cannot be long expoſed to the cold of the external air, without a conſiderable injury of the vital circulation of its juices, which is ſometimes totally deſtroyed by the ſame means; and therefore it ought to be replaced immediately if it is poſſible. But it muſt be obſerved, that the membrane of the omentum is ſo thin, that it will not bear to be roughly handled without laceration; and therefore the greateſt circumſpection muſt be uſed in replacing it; for otherwiſe, by breaking the ſmall veſſels of the omentum in a rough reduction of it, the conſequences may be inflammation, ſuppuration, a gangrene, and a train of the worſt maladies. For this reaſon therefore the wound ought rather to be dilated, that the omentum may be replaced without violence. The moiſture,

[a] Aphoriſm. 58. Sect. VI. Charter. Tom. IX. pag. 289.

warmth, and red blood, viſible in the ſmall veſſels of the omentum, denote that the vital motion of the juices ſtill continues in the part which is prolapſed through the wound.

SECT. CCCXIX.

BUT if the omentum appears dry, cold, or livid, it is to be firſt treated with fomentations, or elſe removed by inciſion before it is replaced.

But when the omentum has lain a conſiderable time out of the wound, it uſually mortifies, and that in a very ſhort time; which may be known from its coldneſs, dryneſs, and livid or black colour. It would be dangerous to return a part thus mortified into the abdomen; for by its ſeparating afterwards from the living parts, it would putrefy in that cavity, and infect all the adjacent viſcera: upon which account Celſus [a] adviſes to conſider the ſtate of the omentum after the inteſtines have been returned into the abdomen: *Ex quo, ſi quid jam nigri & emortui eſt, forfice excidi debet; ſi quid integrum eſt, leniter ſuper inteſtina reduci*; "That if any part of it is already black or "mortified, it muſt be cut off with a pair of ſciſſors; "and if any remains ſound it may be gently returned "over the inteſtines." But if notwithſtanding the change of colour, there remain ſome hopes that the life of the part may be recovered, let it be treated with emollient fomentations, and eſpecially by the application of live animals ſlit open; and when the ſigns of life appear again, to wit, moiſture, warmth, and redneſs of colour, it is then to be returned into the cavity of the abdomen, or elſe what is mortified muſt be cut off. There are however ſome celebrated ſurgeons, who return the omentum if it only appears li-

[a] Lib. VII. cap. 16. pag. 453.

vid

vid in a ſmall degree; and they affirm, that no bad conſequences have followed from thence [b]: for then life eaſily returns into this part by the natural heat of the body. But when the mortified part of the omentum is to be extirpated, a thread is firſt paſſed round the ſound part, and then tied, for cutting off what is mortified under the ligature, at about the diſtance of a finger's breadth from it; the remainder is then returned into the abdomen, taking care that a ſufficient length of the thread may hang out of the wound, that it may be conveniently extracted after the ſeparation is made. Nor has there any great inconvenience been obſerved to follow after a part of the omentum has been thus extirpated. Galen [c] indeed tells us, that a part of the omentum being loſt, renders the ſtomach colder and leſs apt to make a good digeſtion; and affirms, that he has ſeen a certain gladiator, who had loſt almoſt the whole omentum by a wound, and he was afterwards obliged continually to wrap up his abdomen with flannels to avoid injury from the external cold. But it is evident from numberleſs obſervations ſince made, that this accident has not followed a loſs of the omentum [d]; upon which account it would ſeem, that it may be ſafely extirpated, which is alſo confirmed, becauſe we frequently obſerve a great part of the omentum wanting in dead bodies, notwithſtanding the functions of the abdominal viſcera have been duly performed in thoſe perſons.

§ E C T. CCCXX.

PLentiful bleeding, with the injection of clyſters in the beginning when the large inteſtines are uninjured, a proper regimen of diet, a

[b] Dionis Cours d'Operations de Chirurgie demonſtrat. 2. pag. 73. Garengeot Traité des Operations de Chirurgie, Tom. I. pag. 120.
[c] De uſu part. Lib. IV, cap. 9. Charter. Tom. IV. pag. 377.
[d] Acad. des Sciences l'an 1725. pag. hiſt. 13.

quiet

quiet reſpiration with reſt, and a proper poſture of the body, are here the principal remedies.

From what has been hitherto related, ſeveral general methods of relief are deduced, which have been always found highly ſerviceable in the moſt dangerous wounds of the abdomen; theſe are,

Bleeding.] Nothing is here more to be feared than an inflammation of the abdominal viſcera, which ſpeedily tending to a gangrene, after the moſt excruciating pains, often kills the patient in a very little time; but herein we have the moſt relief from plentiful bleeding, which uſually removes the preſent inflammation, and prevents the future. Thus in the incarcerated rupture ſcarce any remedy ſucceeds, unleſs the ſtrength be weakened by a very bold repetition of phlebotomy, ſo as to reſtrain the too great impetuoſity and inflammatory motion of the vital powers.

Clyſters, &c.] If the large inteſtines are injured, it is very evident, that clyſters will be pernicious by eſcaping into the cavity of the abdomen; but if they appear to be entire, then clyſters will be extremely ſerviceable, by diſcharging the hard fœces of the large inteſtines; that the patient may not be afterwards obliged to ſtrain violently upon the ſtool for their expulſion. For in evacuating the bowels, the diaphragm is preſſed downward by the inſpired and retained air, and the abdominal muſcles acting at the ſame time, very ſtrongly, compreſs all the parts contained in the abdomen, which will therefore preſs upon the part wounded, ſo as to force out either the omentum or inteſtines, or elſe lacerate or break open again that which lately began to heal: whence the uſefulneſs of clyſters in wounds in the abdomen is ſufficiently evident.

Diet.] It was ſaid before, under the cure of wounds in general, in § 192. that thoſe aliments are chiefly ſerviceable to thoſe who are wounded, which are of a mild nature and eaſily digeſted or aſſimilated, without

out being apt to putrefy, provided they are taken often and in ſmall quantities at a time. But in wounds of the abdomen it muſt be alſo conſidered, that the action of thoſe viſcera is often injured, which ought to have the greateſt ſhare in changing the crude aliments ſo effectually, that they may be afterwards capable of forming part of ourſelves by the action of the lungs and veſſels; at the ſame time alſo it muſt be obſerved, that a large quantity of aliments taken at once will immediately diſtend the ſtomach and inteſtines; whence it is evident, that great caution is required in managing the diet. But it will be alſo of the greateſt uſe here to give ſuch aliment as leaves the leaſt quantity of groſs fœces in the inteſtines; ſince ſtraining upon the ſtool, after all the fœces have been firſt diſcharged by a clyſter, ought to be avoided as much as poſſible. All theſe intentions are anſwered by nothing better than the uſe of broths of the fleſh of young animals; for if three or four ounces of them be taken every two hours, mixed with a little citron juice to prevent them from degenerating too eaſily into a putrid ſtate, life will then be ſupported with little or no action of the ſtomach and inteſtines to change theſe aliments; and at the ſame time very few or no fœces will be collected in the inteſtines, ſo that the patient may remain without going to ſtool for ſeveral days or even weeks without detriment. Toaſted bread may be ſoaked or boiled in theſe broths, provided it be afterwards taken out to avoid increaſing the quantity of fœces in the large inteſtines: and as for drink, mere water, with the addition of a little wine, will be ſufficient; but a decoction of bread, barley, or oats, or even ſoft ale, may be ſometimes allowed. Milk, if not its whey, is to be here avoided; becauſe it leaves too large a quantity of groſs fœces, as we ſee evidently in infants, who frequently diſcharge very thick and groſs fœces, though they only ſuck the milk of their mother.

Quiet

Quiet reſpiration, reſt, and poſture of the body.] For at every inſpiration the abdominal muſcles are diſtended, and contracted again at the time of expiration, by which means the contents of the abdomen will be alternately compreſſed; therefore the quieter the reſpiration, the leſs will the wounded parts be agitated, and the more eaſily united. For the ſame reaſon too reſt is here very neceſſary; but the poſture ought to be that in which the patient may remain with the moſt eaſe, namely, with the body placed a little erect upon a couch, or ſitting nearly in the ſame poſture, with the orifice of the wound inclined as much as conveniency will permit, that the blood, matter, and other humours may have a ready diſcharge, without being collected in the cavity of the abdomen.

Theſe are the means proper to be uſed in all wounds of the abdomen, as alſo after cutting for the ſtone, or a fiſtula of the anus; for unleſs the patient be not obliged to ſtrain upon the ſtool in thoſe diſorders, the very worſt conſequences may follow, though the operation has been happily performed. It is alſo evident from obſervations, that the moſt deſperate wounds of the abdomen, attended with the worſt ſymptoms, have been happily cured by this method. It will be ſufficient for us at preſent to produce only one inſtance, which we have already mentioned once before upon another occaſion in the commentary on § 170. numb. 5. A mad-man inflicted eighteen wounds in his abdomen, eight of which penetrated its cavity and injured the contained viſcera. The violent fever, tenſion of the abdomen, difficult and painful reſpiration, nauſea, vomiting, diarrhœa, *&c.* afforded a ſevere prognoſis, inſomuch that he was almoſt given over. Phlebotomy was repeated ſeven times in the four firſt days, the diet was very thin, compoſed almoſt entirely of fleſh broths, with the addition of lettuce, ſuccory, purſlain, and the like mild pot-herbs; perfect reſt was

procured

procured with lenient and diacodiate emulſions; and by a careful and ſeldom dreſſing of the wounds with thoſe means, the patient not only recovered from ſo many wounds, but became perfectly well both in body and mind. Seventeen months after this he became mad again, and threw himſelf from a high precipice, by which he was inſtantly killed; and on opening the body, the cicatrices which appeared demonſtrated, that the middle lobe of the liver had been wounded, as alſo had been the inteſtinum jejunum and the colon [a]. This hiſtory demonſtrates how much we may expect from this method in the moſt dangerous caſes.

Of Contusions.

SECT. CCCXXI.

If a hard and obtuſe body does by its motion, reſiſtance, biting, or preſſure, break or lacerate many ſmall veſſels at the ſame time, that injury is termed a contuſion.

A contuſion is a ſolution of continuity made in any part of the body by a hard inſtrument, whoſe ſurface does not terminate either in a point or edge, but in ſome obtuſe figure; for by this it is diſtinguiſhed from a wound, which is a ſolution of continuity made by a wounding or ſharp inſtrument. Hence a contuſion is always *(cæteris paribus)* larger, or occupies a greater ſpace than a wound, becauſe the contuſing inſtrument is applied to a larger ſurface of the body. It now therefore is very evident, that the effect will be the ſame, whether the obtuſe body in motion ſtrike upon a part of the human body, or whether a part of the human body in motion be forced againſt a hard obtuſe and quieſcent obſtacle, or

[a] Acad. des Sciences l'an 1705. Mem. pag. 40, &c.

whether

whether the obtuſe body preſſes upon the part by its own weight, or by pinching cruſhes any part.

SECT. CCCXXII.

THE idea of which is, an aſſemblage of little wounds with a cruſhing of the ſolid fibres and veſſels.

There may be ſo many ſmall wounds conceived in the contuſion as there are injured parts within its circumference, ſo that an aſſemblage of ſmall wounds cloſe to each other gives the whole idea of a contuſion: thus for example, if an artery be divided by a razor, it is a wound; but if it is divided by an infinite number of inciſions very cloſe to each other, it will in a manner repreſent a contuſion of ſuch an artery. But the more ſolid, hard, and reſiſting parts are uſually broke or ground into very ſmall fragments; as for example, when the bones of the arm are by any cauſe broke in two, it is termed a fracture; but if they are cruſhed into ſmall fragments, it is denominated a contuſion.

SECT. CCCXXIII.

THE effects are therefore a ſolution of continuity with laceration, a deſtructive cruſhing of many fibres and veſſels at the ſame time, an extravaſation of the juices into the adjacent vacuities, which are either there naturally ſeated, or made by the accident, with an infinite number of maladies which may follow from thence. A mortal emphyſema, following a fracture and contuſion of the ribs, may be ſeen in Mem. Acad. l'an 1713. pag. 119.

A ſolu-

A ſolution of continuity with laceration.] A laceration is when the ſoft parts of the body are ruptured by diſtracting, and this diſtraction being preſent in all contuſions diſtinguiſhes them from wounds, in which there is alſo a ſolution of the continuity, but without that laceration, ſince a wound is inflicted by a ſharp inſtrument. A wound may indeed be joined with contuſion, but then it is a compound diſorder.

A deſtructive cruſhing, *&c.*] A wound being attended with a ſimple diviſion only of the parts, which before cohered, gives an opportunity frequently for a happy cure, even in the largeſt wounds, by a concretion of the divided parts brought again into contact. But in a contuſion the parts are ſo ground to pieces, that their vital fabrick being deſtroyed, it is impoſſible for them to unite again with the parts adjacent; and this makes a ſeparation of them all neceſſary in order to a cure; becauſe being deprived of all the vital influx of their juices, they are now dead, and are to be conſidered as foreign bodies interpoſed betwixt the living parts, which are thereby prevented from uniting with each other. Hence Hippocrates [a] juſtly pronounces, *Carnes contuſas neceſſario in pus verſas tabeſcere*; "That contuſed fleſh "being converted into matter, muſt neceſſarily be "deſtroyed or waſted." Therefore he would have a ſuppuration to be ſpeedily procured in this caſe.

An extravaſation of the juices into the adjacent vacuities, *&c.*] The veſſels being ruptured, their contained juices are then extravaſated and depoſited in foreign parts. Even Hippocrates [b] has been bold enough to pronounce, that the whole body is full of cavities, *Omne enim non concretum, ſive cute, ſive carne tegatur, cavum eſt. Impletur autem ſanum quidem ſpiritu, ægrotum vero ichore*; "For all that is not con-"creted or ſolid is hollow, whether it be covered "with fleſh or ſkin. The cavity is indeed filled with

[a] De ulceribus, cap. 2. Charter. Tom. XII. pag. 131.
[b] De arte, cap. 8. Charter. Tom. II. pag. 150.

"air

" air in a healthy ſtate, but in a diſeaſed ſtate with " ichor." Therefore the extravaſated humours will every where find a paſſage into theſe ſmaller or larger cavities of the body. For there is ſcarce any veſſel, muſcle, tendon, or even fibre in the whole body, but what is inveſted with a membrane very eaſily dilatable, and compoſed of many cells communicating with each other: the ſmall cells or cavities therefore of this membrane are diſperſed through every part of the body, and may be filled with the juices extravaſated from the ruptured veſſels. But for the larger cavities of the body, ſuch as the ventricles of the brain, the cavity of the thorax, of the veſicles, trachea, and bronchia of the lungs, with the cavity of the pericardium, abdomen, ſtomach, *&c.* theſe are ſufficiently known. But the extravaſated humours may not only fill theſe larger or ſmaller cavities, which are naturally in the body, but they may be alſo there accumulated, and by diſtending or removing the parts which were before contiguous, they may either make new cavities, or elſe greatly increaſe the magnitude of the natural cavities; as for example, after a violent contuſion of the head, the veſſels of the dura mater being ruptured, the blood extravaſated and collected betwixt that membrane and the ſkull, may ſeparate the dura mater from the cranium, to which it before ſtrictly adhered; and thus will a new cavity be formed, which was not there before.

With an infinite number of maladies, *&c.*] All the maladies which follow from contuſion are reducible to three heads; for they either ariſe from a rupture of the ſolids, and an extravaſation of the fluids, which deſtroy the functions reſulting from the determinate motion of the juices through the entire veſſels; or elſe they follow from the preſſure of the extravaſated humours, collected in ſome natural or preternatural cavity of the body, and by their weight or bulk diſturbing or aboliſhing the functions of the adjacent

jacent parts; or lastly, they follow from the putrefaction of the stagnating and extravasated juices, which may acquire an acrimony sufficient to corrode and destroy the circumjacent parts. If now these three circumstances are applied to every particular part of the body, it is evident, that an infinite number of maladies may thence follow, which it would be impossible to enumerate, and therefore it is sufficient for me to have pointed out their general sources. The instance which is here referred to in the Mem. R. Acad. S. teaches us, that violent contusions may be frequently attended with surprising symptoms, not easy to be foreseen by the most skilful in the profession. A man of sixty years of age had his ribs fractured and contused by the wheels of a chariot running over his breast, so that a fragment of a rib slightly wounded the external membrane of the lungs, whence part of the inspired air escaping by the wound into the cavity of the thorax, insinuated itself into the cellular membrane, and inflated almost the whole surface of the body with a surprising emphysema, insomuch that the miserable patient was suffocated on the fourth day after the accident. [c] Parey has formerly observed such a flatulent tumour formed about the ribs after contusions; but he does not seem to have well understood the cause. There are many other instances to be met with in the writers of observations, which teach, that a violent contusion has frequently wounded or separated the liver, spleen, *etc.* without any apparent injury in the external parts, whence sudden death. Even sometimes a violent contusion has been observed to produce sudden death, though no considerable injury could be observed either in the external or internal parts. See what has been said upon this subject, in the commentary on § 274. A remarkable case of this natnre is related in Bohnius [d], of a man who was struck by a stone of several

[c] Liv. XII. chap. 6. pag. 293.
[d] De renunciatione vulnerum, pag. 17.

pounds weight, which was violently flung againſt the right hypogaſtrium, whereupon he ſuddenly fell down and expired. When Bohnius examined the dead body by order of the magiſtrate, he found no injury either in the integuments, viſcera, or veſſels, only the diaphragm was a little contuſed and livid, in that part of the ſame ſide where it is contiguous to the falſe ribs, but the whole compaſs of the bruiſe was ſcarce equal to half a crown.

SECT. CCCXXIV.

BUT the worſt of theſe caſes (323) is, when the internal parts are ſo injured (321, 322, 323), the integuments remaining entire, that the juices ſtagnate, congeal or putrefy; whence an ecchymoſis, a ſpurious aneuriſm, a black or blue ſpot, an ulcer, gangrene, or mortification; and in the glands, a ſcirrhus or cancer.

The ſkin being tough and very coheſive, is not ſo eaſily ruptured by an obtuſe inſtrument; but the veſſels running through the panniculus adipoſis, placed under the ſkin, are much more tender and more eaſily broken. Thus if any one ſhould receive a blow with a hammer upon the finger, the ſkin will generally remain whole, but yet a black ſpot will deform the contuſed part by an extravaſation of the blood from the ruptured veſſels under the entire ſkin; and this more eſpecially happens if the ſubcutaneous veſſels are forced by the contuſing body againſt any ſubjacent hard bone; for which reaſon it is, that ſuch large tumours ſo ſuddenly ariſe, when the head is ſtruck againſt ſome hard obſtacle. But the juices thus extravaſated from the ruptured veſſels, and confined by the entire ſkin, are collected in the cellular membrane, where they ſtagnate, and therefore congeal; and where they may at length putrefy, though but

ſlowly, if no acceſs be given to the external air. Various bad conſequences may from hence ariſe, the principal of which may be referred to thoſe that follow.

Ecchymoſis.] This is an extravaſation of the juices from their veſſels under the integuments, a definition of which is given us by Ægineta [a]: *Carne contuſa a quodam gravi illapſo, et parvis in illa venullis divulſis ſanguis profunditur per diapædeſin: qui, ubi colligitur ſub cute, facit illud, quod vocatur ecchymoma. Non divulſa cute ſic ut tumor mollis tactui cedens ſequatur, lividus et indolens at plurimum:* "The fleſh being contuſed by "the ſtroke of ſome heavy body, and the ſmall veſ- "ſels therein ruptured, their blood is then extrava- "ſated *per diapædeſin*, and being collected under the "ſkin, forms what is called an ecchymoſis. Thus "the ſkin not being divided, a ſoft tumour is form- "ed, which yields to the touch, and is generally li- "vid, and without pain." And thus Galen [b] ſays, that an ecchymoſis is when the blood is extravaſated from the veſſels into the circumjacent ſpaces; and in another place [c], that when the contuſed fleſh extravaſates its blood in a part under the ſkin, the diſorder is termed (ἐκχύμωμα) a ſuffuſion.

A ſpurious aneuriſm.] That is, when a large artery being injured, diſcharges a conſiderable quantity of blood into the panniculus adipoſus, where it is collected under the ſkin; concerning which, ſee the commentary on § 178. So that a rupture of the ſmaller veſſels, extravaſating but a ſmall quantity of blood under the ſkin which remains entire, the diſorder is then termed an ecchymoſis; but when the ſkin is diſtended with extravaſated blood, from the rupture of a conſiderable veſſel, it is termed a ſpurious aneuriſm.

[a] Lib. VI. cap. 30. pag. 66. verſa.

[b] In commentar. in Aphor. 20. Sect. VI. Charter. Tom. IX. pag. 259.

[c] Commentar. 3. in librum Hippocrat. de Medici officina, text. 31. Charter. Tom. XII. pag. 98.

A black or livid ſpot.] When the preſſure of the atmoſphere on the ſurface of the body is either diminiſhed, or wholly removed from any part, either by ſucking, the application of cupping-glaſſes, or the like; the blood then ruſhes into the veſſels of the part leſs preſſed, and diſtends them, ſo as to enter many of the ſmaller dilated veſſels, which did not naturally contain any red blood, and the red parts being impacted in theſe veſſels without being able to return, give the appearance of a red, livid, or often of a blackiſh ſpot. Such a ſpot being formed in any part by ſuction, the part is ſaid to be blood-ſhotten; but when a part, being ſtruck with a hammer, has its blood-veſſels ſuddenly compreſſed by the ſtroke, then alſo the blood may be forced into the lymphatic or ſerous veſſels, and by changing their colour, may produce a very conſiderable ſpot of this kind. Blood-ſhot therefore differs from an ecchymoſis, in as much as the blood is ſtrongly preſſed into the ſerous veſſels without any rupture in the former; but in an ecchymoſis, the veſſels being ruptured, the blood is extravaſated into the adjacent ſpaces; whence the former of theſe takes place, rather about the circumference, than in the middle of the contuſed part. But it is very evident, that both blood-ſhotten and ecchymoſis may both of them follow after violent contuſions, whence they are frequently confounded by authors without diſtinction.

Ulcer and gangrene.] That is when the extravaſated humours corrupt by ſtagnating, and inflame or erode the adjacent parts. Even ſometimes the circulation is ſtopt, by too great a diſtention of the cellular membrane with the extravaſated juices, whence a gangrene and mortification may follow.

Caries.] That is, when the forementioned injuries extend to the ſubſtance of a bone.

In the glands a ſcirrhus or cancer.] Since it is evident from anatomy, that the glands are compoſed of innumerable ſmall arteries, by the different diſpoſition

ſition of which a thin juice is ſeparated from the arterial blood, and being collected, is afterwards diſcharged by an excretory duct; it is therefore evident, that a contuſion of the glands may ſo injure their ſmall veſſels, and compreſs or obſtruct their emiſſaries, as to deny a free paſſage to the humours ſeparated by the arterial fabrick; whence a ſtagnation, and the more fluid parts of the juices being either exhaled or elſe abſorbed by the ſmall veins, an inſpiſſation of the ſecreted juices follow, and forms a hard, indolent, and almoſt irreſolvable tumour, which we call a ſcirrhus; which ſcirrhus becoming inveterate, extremely hard, knotty, and accompanied with pain, is then termed a cancer.

SECT. CCCXXV.

A Contuſion alſo frequently injures the bones, and then follow all the ſymptoms before deſcribed (249, 250, 251, 254, 256, 257), with an injury of the medulla; whence ulcers, fiſtulæ, caries, and putrefactions within the bones; for the medulla in the bones, will be thence affected like the brain in the ſkull, as at (273, 274).

When a contuſion has extended itſelf into a bone it may compreſs or rupture the veſſels which run betwixt the component lamellæ of its ſubſtance; whence the vital circulation of the juices in the lamellæ is deſtroyed, and they therefore mortifying, muſt be exfoliated, or caſt off from the ſubjacent living parts of the bone. But this diſorder may by degrees ſpread itſelf through the whole ſubſtance of the bone, in the manner explained before under the aphoriſms here cited, treating of the ſeveral injuries of the bones of the ſkull.

An injury of the medulla, &c.] This is an accident the moſt of all to be feared in contuſions of the bones; for the marrow is lodged within the cavities of the larger bones, and there is a like ſubſtance interſperſed betwixt the cells or ſpungy parts of the bones. But as the brain is defended with a bony covering, ſo the medulla lies ſecured within the cavity of the bone; and as the brain is covered with a peculiar membrane, called the pia mater, which receives and diſtributes the veſſels entering its ſubſtance; in the ſame manner alſo is the medulla inveſted with a fine vaſcular membrane, for the ſame uſes. The arteries of the pia mater, having depoſited their thicker coats, appear very thin; and the ſame is alſo true, in the arteries which are extended to the ſubſtance of the medulla; ſo that the marrow taken out of the thigh bone of an old ox, may be eaſily preſſed into a mere oil betwixt the fingers, notwithſtanding it appears to be furniſhed with innumerable arteries. Alſo as a fiſſure, fracture, or contuſion of the ſkull, may communicate its diſorders by the corrupted or extravaſated humours, ſo as to infect the brain itſelf; ſo likewiſe an injury in a bone may be extended to its medulla. A violent concuſſion of the head may rupture many of the ſmall veſſels of the encephalon, while the ſkull remains entire; and it is very evident, that the ſame may alſo happen to the medulla, if a bone which contains marrow is violently ſtruck by a blow. Now when the tender veſſels of the medulla receive the diſorder from the inveſting bone, or are injured by any other cauſe, the medullary oil, extravaſated from the ruptured veſſels, ſtagnates, and thereby acquires a moſt malignant and rancid acrimony, ſo as to erode all that it touches, and render the bone itſelf carious; whence follow moſt malignant and almoſt incurable ulcers, with obſtinate fiſtulæ, not to be cured, unleſs the parts can be cleanſed from the corrupted medulla. From this malignant eroſion, by the putrid oil, follow a deſtruc-

tion

tion of the parts, with an infinite number of other diſorders, of which we ſhall treat hereafter, in the diſeaſes of the bones, at § 526.

SECT. CCCXXVI.

AND ſometimes the muſcles are alſo injured in like manner by contuſions, whence large abſceſſes or ſuppurations, gangrene, palſies, or a ſtiffneſs or contraction: but if the contuſion deſtroys large nerves which diſtribute many branches, it then certainly produces a palſy, a withering, inſenſibility, or a gangrene of the parts below, not to be cured by any art; but this is more eſpecially true of the *ſpina dorſi*, and its contained medulla.

Muſcles.] It appears from the modern anatomy, that any viſible muſcle may be divided into ſmaller bundles of muſcular fibres; nor have we hitherto been able to find out the extent of this diviſion, even though aſſiſted by microſcopes: for no one has been ever yet able to ſee a ſingle muſcular fibre, but always ſeveral fibres appear collected together. Theſe faſciculi of muſcular fibres are inveſted with a thin cellular membrane, which contains a ſubtile oil for lubricating thoſe fibres. But the ſmall arteries are very numerouſly diſperſed betwixt the interſtices of thoſe faſciculi, within the cellular membrance, as the injections of Ruyſch demonſtrate, inſomuch that they ſeem to conſtitute almoſt the whole ſubſtance of the muſcle. Theſe arteries are likewiſe accompanied with ſimilar ſmall veins, as alſo with nerves, throughout the whole ſubſtance of the muſcle. A contuſion of a muſcle may therefore break theſe veſſels, and extravaſate their juices in the cavities of the cellular membrane, where being collected, they may compreſs the adjacent veſſels. The extravaſated juices may be alſo cor-

rupted, and by their acquired acrimony, they may corrode the parts within their contact; whence inflammation, ſuppuration, gangrene, and the reſt of the diſorders that may thence follow. But ſuppurations ariſing from this cauſe are the worſt of any, becauſe the matter formed in the thin cellular membrane, which inveſts the muſcular fibres, will make itſelf ſurpriſing paſſages, ſo as to run through all the tracts of this membrane, forming fiſtulæ and ſinuſes of the worſt kind. Add to this, that the cellular membrane being conſumed by a long ſuppuration, may give occaſion for the faſciculi of muſcular fibres, which it diſtinguiſhed from each other, to grow afterwards together; whence the free motion of thoſe fibres will be impeded, in their diſtention, by thoſe cauſes which move the muſcle, by which means the action of the muſcle itſelf will be either depraved, or totally deſtroyed. Alſo the muſcular fibres themſelves, ſtrictly ſo called, may be deſtroyed by a violent contuſion; whence the muſcular motion will ceaſe, which depended upon the continuity of theſe fibres, and the muſcle will become paralytic, which is an inability of any muſcle to motion, with a flexibility and laxity of the affected muſcle. But alſo a contraction of the limb may from thence follow, when the cellular membrane, which diſtinguiſhes the muſcular fibres, being deſtroyed by a violent ſuppuration, occaſions the fibres to grow to each other, ſo as to intercept the influx of their thinneſt juices; whence a gradual contraction or ſhrinking of the muſcle, which can be no more elongated by any diſtracting power, and from thence may ariſe ſurpriſing contractions, or diſtortions of the limbs; which may alſo proceed from the action of any muſcle being deſtroyed, while the action of its antagoniſt prevailing, continually draws the limb towards its origin, where it at length ſtiffens: hence it is that a contraction of a limb ſo frequently follows an inveterate palſy.

But

But when muſcular fibres are ruptured by a contuſion, without deſtroying the action of the muſcle, it ſeems then to produce that very painful diſorder which the ancient phyſicians called (σπάσμα) a pulling or (ῥήγμα) a rupture. Galen [a] treating of a contuſion, ſays, *Manifeſtum autem, quod parvæ venæ una cum carne dividuntur in ſuffuſionum* (ἐκχυμωμάτων) *generatione. Vulſiones* (σπάσματα) *autem fiunt circa fibras muſculorum amplius diſtentas, ut nonnullæ rumpantur, et vocant proprie juniores Medici hos affectus rupturas* (ῥήγματα). *Horum autem primus Hippocrates meminit, etc.* "But it is manifeſt, that the ſmall veſſels "are divided together with the fleſh, in the forma- "tion of contuſions (ἐκχυμωμάτων.) But contractions "(σπάσματα) are made upon the fibres of the muſ- "cles which are moſt diſtended, ſo that ſome of "them are broke; which diſorder is properly called "by ſome of the younger phyſicians (ῥήγματα) rup- "tures. But among theſe Hippocrates is the "firſt that remarks, &c." Theſe ruptures are thus deſcribed by Hippocrates, [b] *Quibuſdam autem, cum imbecilles in carnibus aut venis vulſiones factæ fuerint, non ſuppurantur, ſed diuturni fiunt dolores, & vocant ruptiones* (ῥήγματα): "But ſome people having a weak "diſtention in the fleſh or ſmall veſſels, a ſuppura- "tion does not follow, but laſting pains are produced "which are called (ῥήγματα) ruptures." And in the end of the ſame chapter he adds, *Fiunt enim vulſiones à laboribus, et caſibus, et à plaga, et ſi quis onus majus tollat, et à curſibus, et luctâ et ejuſmodi omnibus:* "For contractions ariſe from hard labour, from acci- "dents, and from wounds, or when a perſon lifts "too great a weight; as alſo from running, wreſt- "ling, and all ſuch like motions." He ſeems alſo to have ſpoke of this in his Prænotiones Coacæ [c],

[a] Commentar. 3. in librum Hippocrat. de Medici officina text. 31. Charter. Tom. XII. pag. 98.

[b] De morbis, Lib. I. cap. 8. Charter. Tom. VII. pag. 541, 542.

[c] N°. 425. Charter. Tom. VIII. pag. 877.

where

where he ſays, *Vulſiones omnes quidem moleſtæ fiunt, et dolores in initio intenſos producunt, et in poſterum aliquos commonefaciunt, difficillimæ autem circa thoracem et maxime periculoſæ:* "That all diſtractions are uneaſy, and at firſt produce intenſe pains, but afterwards they give but ſlight uneaſineſs, being very obſtinate, and the moſt dangerous about the thorax." But it muſt be obſerved, that in the tranſlation they have rendered (σπάσματα) *convulſiones*, improperly; ſince theſe are called (σπάσμοι). But Galen [d] obſerves to us, that the muſcular fibres thus divided are very difficultly conjoined again; for it was his opinion, that the ruptured fibres would eaſily enough unite, if the ecchymoſis was ſpeedily diſperſed; but when that continued a long time, then the foul humours collected betwixt the ruptured fibres interpoſed, and obſtructed them from uniting; ſo that from the great fatigue, fever, and leſs perfect digeſtion of the aliments, with ſuch like cauſes, the pain returned again. Perhaps there may be ſomething of this nature in the muſcles after violent ſtraining, in lifting up great weights, *&c.* For ſevere and ſudden pains then ariſe, which frequently torment the patient for a long time, and are exaſperated by the leaſt motion of body. Certain it is from experience, that an abſolute reſt of body is the chief remedy in theſe pains: and Hippocrates [e] directs, for the cure of theſe ruptures or diſtractions of the muſcular fibres in the thorax, that the patient muſt abſtain a year from labour; and in another place [f], after ſaying that this diſorder ariſes from immoderate labour, he obſerves, that reſt of body is highly neceſſary; otherwiſe the diſeaſe will return, and torment the patient worſe than at the firſt.

[d] Method. Medend. Lib. IV. cap. ultimo. Charter. Tom. X. pag. 102.

[e] De Morbis, Lib. II. cap. 24. Charter. Tom. VII. pag. 576.

[f] De Internis affectionibus, cap. 9. Chart. Tom. VII. p. 644.

But

But if large nerves, &c.] If we consider the nerves in their origin, at the medulla oblongata and spinalis, they evidently appear very soft; and if the extremities of the nerves be also considered, in those parts where they deposite their integuments to form a sensitive organ, for conveying ideas to the mind by the new changes or impressions made upon them by external objects, how tender do they there appear! This is evidently demonstrated by the pulp of the auditory nerve, and in the retina of the eye, which last immediately collapses into a shapeless mucus, if it is not sustained by the equable pressure of the ambient humour. But these tender nervous threads are safely conveyed from their origin, to the extreme parts of the body, under the defence of tough coats and integuments. If therefore a large nerve should be contused in its course, the soft pulp-like substance of it may be injured, or even destroyed, while the integuments of the nerve appear uninjured; from whence all those functions will be destroyed, which resulted from the sound structure of the several smaller nerves, collected together in the large one. This appears evident in the experiment of Valsalva, mentioned in the commentary on § 276. numb. 5. For when he made a strict ligature with a thread upon the cardiac nerves of a dog, and removed the ligature soon after, the animal perished in a few days time, in the same manner as if these nerves had been divided, and yet there was no sensible injury appeared in the nerves, after death. For in this case the ligature so compressed the soft and pulp-like substance of the nerves, that the free influx of the spirits through them was wholly intercepted.

But why an incurable gangrene follows the destruction of a large nerve, and especially from an injury of the spinal medulla, we have already declared in the commentary on § 162, where some remarkable cases are alledged for confirming this doctrine.

SECT.

SECT. CCCXVII.

EVEN a contuſion frequently deſtroys or cruſhes the viſcera themſelves; and then follow an inflammation of them, a ſuppuration, a gangrene, ſcirrhus, and an injury of their functions.

What bad conſequences ſometimes follow after violent contuſions of the head, by which the brain itſelf is injured, has been already obſerved in the hiſtory of wounds in the head. The viſcera contained in the cavity of the thorax, are on all ſides ſecurely defended by the arched ribs, the ſternum, and ſpina dorſi; and yet the wonderful caſe related at § 323, demonſtrates, that even theſe viſcera may be ſometimes injured by contuſions, ſince a fragment of the ribs lacerated the external membrane of the lungs, and produced a ſurprizing emphyſema, with death itſelf. But the abdominal viſcera are more liable to be injured by contuſions; ſince they are for the moſt part covered only by the ſoft integuments and muſcles of the abdomen; and though the ſpleen and the largeſt part of the liver are defended by the falſe ribs, yet have theſe viſcera been ſometimes ſo violently cruſhed by contuſions, that death itſelf has ſpeedily followed, as appears from the obſervations related at § 170. numb. 3. Nor will this appear wonderful, if it be conſidered that the ſubſtance of the liver and ſpleen is ſo tender, that unleſs great caution be uſed, they cannot be taken whole out of the dead body; from whence it is, that violent contuſions of the abdomen ſo often prove fatal, in a ſmall ſpace of time. Parey[a] relates, that two boxers fighting, one of them being of a ſmall ſtature, but thick and ſtrong, forcibly threw down the other, who was very tall;

[a] Oeuvres d'Ambroiſe Pare. Apologie & Voyages, pag. 783.

whereupon

whereupon the tall one being enraged, took his elbow, and puſhed it with the whole weight of his body againſt the ſcorbiculum cordis of his adverſary, whereby the unhappy man inſtantly ſtretched out and expired. A large quantity of extravaſated blood was found in the cavity both of the abdomen and thorax. There are innumerable obſervations to be met with in authors, from whence it appears that ſeveral of the viſcera have been ſo injured from violent contuſions, that death, and the worſt conſequences, have thence followed. For by this means the veſſels may be ruptured, and their contained juices extravaſated, which by putrefying may corrode all the adjacent parts; whence again may follow the worſt conſequences, as inflammation, with all its attendants; namely a ſuppuration, gangrene, *&c.* And ſince the functions of all the viſcera depend upon the continuity of their veſſels, and the regular motion of the juices through them, it is again evident, that thoſe functions may be injured, or even totally aboliſhed by contuſions.

SECT. CCCXXVIII.

FROM hence (322 to 328,) it is eaſy to explain the many ſurpriſing and miſerable ſymptoms and diſorders, which uſually follow from contuſions (321); and an infinite number both of acute and chronical diſeaſes may be thence predicted.

If now, what has been ſaid at § 322. concerning the idea of contuſion, with the inſeparable effects of every contuſion, enumerated at § 323, are applied to the ſeveral different parts of the body, which are capable of being injured by contuſion, it will immediately appear what bad conſequences are thence to be feared; which may be then ſafely predicted, from the known

known fabrick and uſes of the parts: as for example, if any one ſhould fall and ſtrike the right hypochondrium againſt a hard obſtacle, and ſoon after a conſiderable yellowneſs appears in the eyes and ſkin; it will be thence evident, that the bile being preſſed back, has infected the maſs of blood, and that therefore the region of the gall-bladder, and liver itſelf, have been injured by the contuſion. If again it be conſidered, that the ſubſtance of the liver is ſo very tender, that it reſembles a ſponge full of blood, there is great danger leſt a large quantity of blood ſhould be extravaſated from the ruptured veſſels, within the cavity of the abdomen; whence convulſions, faintings, and death itſelf may often enſue, in a ſhort ſpace of time. But if the injury is ſlight, and only the ſmaller veſſels are ruptured, within the ſubſtance of the liver; even then the extravaſated humours may compreſs the adjacent veſſels, or elſe corrode them by putrefying, ſo as to produce an inflammation, ſuppuration, ſcirrhus, &c. in this viſcus; whence death ſlowly follows, after the patient has endured the greateſt miſeries. If the region of the loins ſhould be injured by a violent contuſion, and bloody urine follows, we know then that the ſmall veſſels of the kidneys are ruptured; whence again may follow the very worſt accidents: for the grumes of congealed blood eſcaping into the narrow paſſages of the pelvis and ureter, may wholly intercept the courſe of the urine from the kidney to the bladder; whence an inflammation of the kidney, ſuppreſſion of urine, &c. may follow. Even a ſmall particle of congealed blood, left in theſe paſſages, may form the baſis of a calculus, to which the earthy particles will on all ſides adhere; whence a train of new maladies again follow. If now it be conſidered that the like injury may happen in the other viſcera, it will be very evident that innumerable diſorders may thence follow, which will either kill the patient in a little time, by extravaſating the juices, and deſtroying the fabrick of the parts, whoſe

whoſe continuity is abſolutely neceſſary to life, or otherwiſe, the patient may ſurvive under the burden of diſeaſes, from the injured functions of the parts, whence many chronical and often incurable diſorders follow. This is demonſtrated by an unlucky accident in a bold commander, who ruſhing againſt the enemy upon a fierce horſe, that received a wound, the horſe ſuddenly raiſed himſelf, by which means the pummel of the ſaddle was very violently preſſed againſt the region of his ſtomach. A vomiting of much blood immediately followed; and as the noble perſon could not obſerve a proper regimen of life, and as he drank much wine, quite neglecting ſo great an accident, though he ſurvived a conſiderable time, he was troubled with excruciating pains in his ſtomach, during life, till at length a very troubleſome vomiting, dyſentery, *&c.* put a period to his miſeries by death; and on opening the body, a large part of the liver, and the whole pancreas, were found cancerous. Thus alſo the worſt maladies may follow from a contuſion of the teſticles. I ſaw a ſcirrhous teſticle from this cauſe, which being imprudently treated with emollient and ſuppurating medicines, grew to ſuch an uncommon bulk, that the ſcrotum with its included teſticle nearly extended to the knee of the ſame ſide; and which was afterwards eroded by a frightful cancer, that occaſioned death, after the worſt calamities, in a perſon who was otherwiſe very healthy.

SECT. CCCXXIX.

A Preſent contuſion, with the part it affects, is known, 1. by inſpection, and by the touch; 2. by its effect, pain, numbneſs, heavineſs, a change of the colour to red, brown, livid or like lead, black, yellow, or green, a hæmorrhage, gangrene, *&c.* (323 to 327); 3. by comparing the ſhape and violence of the contuſing

contuſing inſtrument, with the nature of the part injured.

This aphoriſm treats of thoſe ſigns by which a contuſion is known to be preſent, and by which the part affected is diſcovered.

1. For the veſſels being ruptured under the entire ſkin, their extravaſated juices fill and diſtend the panniculus adipoſus; whence a tumour and ſoftneſs of the contuſed parts appear to the eye and touch; and this more eſpecially in contuſions of the head, becauſe the hard ſkull occaſions the extravaſated juices to make the greater diſtention of the integuments outwards: which is elegantly expreſſed by Terence[a], where a procurer being heavily fined for his deſerts by a youth, ſays:

Omnes dentes labefecit mihi!
Præterea colaphis tuber eſt totum caput.

2. Pain attends almoſt in every contuſion; but when the contuſion, being very violent, has deſtroyed almoſt all the veſſels, there is then only a very obtuſe or no pain; but in ſuch a caſe there is a numbneſs, and a dull ſenſation in the affected part, which denotes that the ſenſible nerves are deſtroyed in the contuſed places, or are elſe ſo compreſſed by the extravaſated humours, and the contuſing inſtrument, that they remain no longer ſenſible. But as the extravaſated blood is generally collected under the entire ſkin, the colour of the contuſed part will be altered, according to the different quantity of extravaſated blood, and alſo according to the different time that is paſs'd ſince the contuſion was inflicted. For a ſlight contuſion is followed with a red colour, there being but little blood extravaſated, from a rupture only of the ſmaller veſſels; but yet that redneſs be-

[a] Adelph. Act. II. Scen. II. ver. 36.

comes

comes more obſcure after a few hours, and inclines to black. But after a violent contuſion, the colour of the part affected is often inſtantly changed to a leaden, livid, and frequently a black, from the large quantity of blood lodged under the entire ſkin; and although the colour was red at firſt, yet, by the exhalation or abſorption which is afterwards made, of the thinner parts of the blood, the remainder turns black. But this leaden or livid colour of the contuſed part, ought not to give us any great ſurprize; for it is not always the mark of a gangrene, which may be eaſily diſtinguiſhed by the coldneſs and elevation of the cuticle into veſicles, full of ichor, appearing in the morbid part. When the concreted blood begins to diſſolve and be diſperſed, then the leaden or black colour becomes gradually fainter, and begins to incline to red; and a yellow or greeniſh colour appears in the margin of the contuſed part, from the gradual diſſolution and diſſipation of the red part of the blood; which green or yellowiſh coloured margin is therefore a ſign that the extravaſated and concreted juices begin to be diſſolved. It is well known, that when blood is drawn from the vein of a healthy perſon, it ſoon afterwards ſeparates into two parts; the one a limpid ſerum, and the other a red concrete floating in the ſerum. If now all the ſerum is poured off, there will appear a conſiderable quantity more in a few hours time, as the red concrete gradually diſſolves; ſo that by frequently pouring off the ſerum, almoſt the whole red part will at length vaniſh. The ſame diſſolution ſeems to happen in theſe contuſions, where the concreted blood is by degrees reſolved into a thinner ſerum; from whence follows that change of colour in the contuſed part, when the extravaſated blood begins to be attenuated and diſperſed. This circumſtance has been well obſerved by Hippocrates [b], where he treats of a fracture in the calcaneum; for he reckons it one of the beſt ſigns, denoting that there

[b] De Fracturis Textu 30 & 31. Charter. Tom. XII. pag. 205.

is no danger. *Si ſuffuſiones* (ἐκχυμώματα) *& nigredines, & circumambientia loca ſubvirideſcant, ſine duritie. Optimum illud teſtimonium in omni ſuffuſione, &c.* "If in "contuſions the circumjacent parts look greeniſh, "without hardneſs and black ſpots. And that this "ſign is of the beſt import in every contuſion," *&c.*

Unleſs a conſiderable wound is made in the ſkin, there ſeldom happens any profuſe hæmorrhage in a contuſion; for the blood extravaſated from the ruptured veſſels, being collected in the panniculus adiposus, congeals and ſtops up the courſe of the blood, which is about to eſcape. But if the viſcera or larger veſſels are much injured by contuſion, a large quantity of blood may be extravaſated within the cavities of the body: as when, for example, the liver ſhall be thus injured; but then paleneſs, coldneſs of the extremities, great weakneſs, fainting, *&c.* ſufficiently denote ſuch an internal hæmorrhage. But when all the veſſels in any part of the body, are ſo deſtroyed by a violent contuſion, as to aboliſh all the vital influx and reflux of the juices, into and from the part, a gangrene or death of that part is then preſent.

3. We know a contuſion is preſent, when we are informed that ſome hard and obtuſe body in motion has ſtruck upon the part, or that ſome part of the human body in motion has been forced againſt ſome ſuch hard obſtacle. Hence a wound is frequently accompanied with contuſions, unleſs the wounding inſtrument was ſharp. At the ſame time too the nature and ſituation of the part injured muſt be alſo conſidered; as for example, that the viſcera of the thorax are leſs expoſed to injury by contuſions, and that the viſcera of the abdomen are more eaſily expoſed to the ſame injury.

SECT.

SECT. CCCXXX.

AND it is hence well known; 1. that an internal and large contuſion, in one of the more noble viſcera, is incurable; and muſt therefore occaſion ſeveral diſeaſes, and death itſelf. 2. That a contuſion in the bones is very dangerous, and difficult to cure; eſpecially when near their articulations or medulla. 3. That a contuſion of the ſkull is worſt of all, as we before demonſtrated, from the vicinity of the brain. 4. That contuſions of the larger glands ſeated at the ears, arm-pits, breaſts, or the groins, uterus, pancreas, *&c.* threaten a ſcirrhus, cancer, and the diſorders that may thence follow.

What prognoſis ought to be formed, from a knowledge of the part injured by contuſion, is made evident in this aphoriſm.

1. For the veſſels being ruptured, will either produce a fatal hæmorrhage, uncapable of being ſuppreſſed; or elſe the contuſed parts muſt be ſeparated by ſuppuration from the ſound, as Hippocrates obſerves, in the place cited from him in the commentary on § 323; but from internal ſuppurations a conſumption very frequently follows, which ſlowly deſtroys the unhappy patient. Beſides this, ſince all the viſcera have a ſhare in conſtituting the health of the patient, therefore the function of the diſeaſed viſcus will be ſo much depraved after the ſuppuration, that if the patient ſurvive, it will be in a miſerable and diſeaſed ſtate. Now as theſe injuries by contuſion happen more frequently in the liver and ſpleen, from the exceeding tenderneſs or friability of thoſe viſcera, it is very evident, that the worſt conſequences may be there expected, and that the cure will be extremely

difficult, the patient being very rarely reſtored to a perfect ſtate of health, becauſe more or leſs of a ſcirrhus almoſt conſtantly remains during life, which will diſturb the functions of the injured viſcera.

2. For a rupture of the veſſels, which afford life and nouriſhment to the lamellæ of the bone, will occaſion them to mortify and ſeparate; but if ſuch a contuſion is made near the articulations in the larger bones, there is ſcarce any room to hope for a ſeparation or exfoliation of the dead parts: becauſe in thoſe places the lamellæ of the bones recede from each other, and form cells, in which the blood-veſſels are diſtributed in great numbers, together with thoſe veſſels which contain the thin oil, which juices will be therefore corrupted by ſtagnating, and acquire a putrid acrimony, ſufficient to deſtroy the parts, whence a caries of the bone, and all the maladies that may thence follow. But if the medulla itſelf is injured, the very worſt or rancid acrimony thence follows, ſufficient to corrode the whole ſubſtance of the incumbent bone. See what has been ſaid in the commentary on § 325. To which add, that the bones cannot be contuſed near their articulations, without injuring the ligaments at the ſame time, which articulate the bones, whence excruciating pains, anchyloſes, *&c.* may follow.

3. Of this we treated before, in the hiſtory of wounds in the head.

4. Conſult what has been ſaid in the commentary on § 324. In all the places here enumerated, there are very conſiderable glands ſeated, from a contuſion in which the very worſt maladies may follow. Among ten caſes where the breaſts are ſcirrhous or cancerous, nine of them are probably from contuſion. Agreeable to this, I ſaw an unhappy woman, whoſe child lying with her, with its whole weight upon her breaſt, made a contuſion with its elbow, by endeavouring to turn itſelf, whence a ſcirrhus followed throughout the whole breaſt, which was conſiderably tumified,

tumified, and in a few weeks time degenerated into a frightful cancer. The like injuries have been frequently obſerved in the parotid axillary and inguinal glands, ariſing from contuſion. But the uterus, in women who are not with child, is ſufficiently well ſecured on all ſides, by the bones of the pelvis; ſo that it cannot be eaſily contuſed, as it may in thoſe who are far gone with child, when the bottom of the uterus riſes up above the oſſa pubis: but the uterus may be alſo injured by the imprudent handling of the midwife, or by the difficulty of the birth; from whence a ſcirrhus of the uterus, degenerating into a cancerous ulcer, has been very frequently obſerved.

SECT. CCCXXXI.

IN the cure of a contuſion it muſt be always endeavoured to procure a diſcuſſion, to prevent a ſuppuration, and more eſpecially a gangrene.

Since the ſolid parts of the body are broken in pieces by contuſion, and the extravaſated juices are let into foreign parts; it is therefore required in order to a cure, to diſcharge the extravaſated juices, and to unite the ſolid parts which are divided. This will be moſt happily procured, if the concreted juices are rendered fluid; for then they may be abſorbed by the bibulous veſſels, and returned into the common courſe of the circulation. This method of cure is ſaid to be by reſolution or diſperſion. But a ſuppuration muſt be here avoided, if poſſible; becauſe by that means much of the ſubſtance of the contuſed part is deſtroyed, by a ſeparation of all that does not admit the circulating juices, from whence unſightly ſcars frequently remain; and the cellular membrane being conſumed after a violent ſuppuration, often occaſions

caſions the muſcles and tendons to adhere to the adjacent parts, whence their action is either depraved or aboliſhed. But it is certain, that a ſuppuration cannot always be prevented; though it is alſo equally certain, that ſome contuſions may be frequently removed or diſperſed, by the application of thoſe remedies mentioned in § 333, 334, by the neglecting or the too late uſing of which, it would certainly tend to ſuppuration. But it is very evident, that a gangrene ought to be ſtill more induſtriouſly avoided, as that wholly deſtroys the vital influx and efflux of the juices to and from the part affected; which being afterwards mortified, muſt be then ſeparated by ſuppuration, from the adjacent living parts.

SECT. CCCXXXII.

A Reſolution or diſcuſſion is procured by removing the extravaſated juices, without any farther injury to the veſſels.

It is a general indication in all contuſions, to remove the extravaſated juices; but if, for example, a diviſion of the contuſed part by inciſion, will give a vent to the extravaſated blood, this cannot be termed reſolution, becauſe the parts ſuffer a new injury. The ſame is alſo true, when the cure is performed by ſuppuration; for then the extremities of the injured veſſels are ſeparated, and diſcharged with the extravaſated juices, in the form of pus. But in order to a reſolution, it is required that no farther injury be offered to the parts, while the extravaſated juices are in the mean time carried off; and this is what Hippocrates [a] terms the drying up, or abſorption of extravaſated blood: for in treating of thoſe diſorders which follow a contuſion of the fleſh about the ribs, without a fracture of them, after deſcribing the pro-

[a] De Articulis textu 66. Charter Tom. XII. pag. 397.

per

per remedies, he adds, that a ſuitable bandage is neceſſary, ἕως ἂν ξηρανθῇ μεν ᾖ ἀναποθή τοῦτο τὸ ἐκχύμωμα, τὸ ἐν τῇ θλάσει γενόμενον: "But as for the blood which "is extravaſated in the contuſion, let it be dried up "and abſorbed." But in what manner, and by what means, this reſolution may be obtained, is declared in the following aphoriſm.

SECT. CCCXXXIII.

BUT this reſolution is procured, 1. by rendering the juices fluid; 2. by relaxing the adjacent veſſels; and 3. by directing the juices into the veſſels, by evacuating them, and by frictions.

1. The blood extravaſated from the veſſels, immediately concretes, and by that means is rendered unfit both for paſſing through the ſmaller blood-veſſels, and for being abſorbed by the mouths of the veins. The firſt thing therefore required, is, to render the concreted juices fluid. For if the extravaſated juices can be reduced to the tenuity of water, they will certainly be diſperſed, provided the body is healthy in other reſpects. Hippocrates [a] pronounces, *Carnes attractrices ex cavo, & extrinſecus:* "That the fleſh attracts "or abſorbs, both from within and without." And he alſo acknowledges the whole body to be perſpirable, or expirable and inſpirable. The extravaſated juices will be therefore abſorbed by the bibulous veins, which open in all the larger and ſmaller cavities of the body, provided it be ſufficiently attenuated to enter them.

2. All the attenuated juices which are to be abſorbed, muſt enter the exceeding ſmall bibulous veins, and be conveyed by them to the larger branches. Now it appears from inconteſtible experiments, that

[a] Lib. 6. Epidem. in initio. Charter. Tom. IX. pag. 540.

any of the ſmalleſt tubes, made of the pureſt glaſs, by drawing out at a lamp, upon having one end immerged in any liquor, will attract the liquor into their cavity; and that the liquor will aſcend higher into the tube, as it is of a ſmaller bore, and more inclined from the perpendicular, towards the horizon; but the moſt of all when one end of it is inclined lower than the other, for then the attractive force, by which the liquor is drawn into the tubes, is aſſiſted by gravity. The like action ſeems to obtain, when the extravaſated humours being firſt attenuated, enter the exceedingly minute tubuli of the abſorbing veins. But the valves which are conſpicuous in the ſmalleſt lymphatic veins, prevent their contained humours from reſiſting the ingreſs of the abſorbing juices. Now flexible canals are the more eaſily filled, in proportion as their ſides give a leſs reſiſtance; and therefore relaxation of the adjacent veſſels facilitates the courſe of the abſorbed juices, through the exceedingly minute ducts, into the larger venal branches, which is here required.

3. The juices thus abſorbed by the minute venal ducts, will go on more eaſily through the large venal branches, as they contain leſs humours to be moved; provided the powers, which promote the motion of the venal blood, remain the ſame; *viz.* principally the pulſation of the arteries, contiguous to the veins, with the motion of the muſcles; for the muſcles ſwelling in their action, compreſs the adjacent veins, and drive the blood through them towards the heart. If therefore the maſs of humours to be moved is diminiſhed, and the moving powers remain equally ſtrong, it is evident that the veins will be more ſpeedily evacuated, by which means the juices to be abſorbed by the minute bibulous ducts, will have a more eaſy entrance. This doctrine is alſo confirmed by experiments; for when men travel in the ſcorching ſun, having their bodies rough, and their mouths parched up with excruciating and burning thirſt, they have been

been ſurprized to find their thirſt extinguiſhed, and their mouths moiſtened, after bathing, which has rendered the whole body ſo moiſt and ſoft, that none of the former roughneſs appeared. This is an experiment produced by Galen[b], to prove, that the whole body is inſpirable. For by violent exerciſe in a very hot air, many of the thin juices are exhaled from the body, by which means becoming very dry and bibulous, it eagerly abſorbs the water contiguous to its external ſurface. Perhaps it may be from hence that the body is filled with watery humours, after great loſſes of blood, when the ſmall abſorbing veins very eaſily diſcharge the abſorbed humours into the larger empty veins: but in the mean time, the ſtrength being weakened, and the heat of the body diminiſhed, occaſions the thin watery juices to be accumulated in the larger and ſmaller cavities of the body, which are ſaid by Hippocrates to contain ſpirits in a healthy ſtate, and ichor in a diſordered ſtate, as we obſerved in the paſſage before cited in the commentary on § 323. And perhaps from thence may be deduced the reaſon why dropſical patients ſo ſoon ſwell again, after all the water has been diſcharged by paracenteſis, or any other way, even though they abſtained from drink: for notwithſtanding a very large quantity of water is collected in the cavities of the body of the dropſical patient, yet the reſt of the veſſels collapſe, and are evacuated, whence the reſt of the body conſumes in proportion as the abdomen is diſtended in an aſcites, whence the body becomes more bibulous.

But frictions, with a gentle compreſſion, act more upon the veins than upon the arteries; becauſe the coats of the veins are thinner, whence the veins will be emptied; and as there is an alternate compreſſure and relaxation of the parts, in all frictions the veins will by that means be firſt emptied, and then directly

[b] Commentar. in Lib. 6. Epidem. Hippocr. Charter. ibid. pag. 541.

filled

filled again; ſo that frictions will produce much the ſame effect with evacuations; namely, by emptying the veſſels, they will facilitate the ingreſs of the juices, to be abſorbed through the ſmall mouths of the bibulous veins. Add to this, that the extravaſated and concreted blood itſelf, will alſo be attenuated and reſolved by the friction: for if the blood which has been taken from the vein of a healthy perſon, and congealed in the open air, be ground in a glaſs mortar, it will be again diſſolved into a frothy and red coloured liquor; and therefore frictions are evidently of the greateſt uſe in the cure of convulſions.

SECT. CCCXXXIV.

THerefore plentiful blood-letting, with the exhibition of a cooling purge, that acts briſkly without inflaming; the application of diſcutient, relaxing, and penetrating fomentations to the part itſelf, with warm frictions, and the internal uſe of attenuating, ſudorific, and diuretic medicines, will be here ſerviceable.

In this aphoriſm are enumerated the moſt efficacious remedies, for anſwering the curative indications propoſed in the aphoriſm preceding.

Plentiful blood-letting.] For this is one of the chief remedies in all contuſions, provided the patient is ſtrong; and therefore it ought to be boldly uſed, and repeated as may be found neceſſary. Thus an intenſe fever and inflammation, which are the moſt to be feared in theſe diſorders, may be prevented; becauſe the groſſeſt parts of the juices, namely, thoſe of the red blood, are thus evacuated from the veſſels, and an eaſy paſſage given to the thinner juices taken into the body. At the ſame time alſo, the depletion of the larger veins by phlebotomy, will facilitate the abſorp-

abſorption, and the tranſmiſſion of the juices imbibed by the ſmalleſt veins, towards the larger branches, whence the extravaſated blood will be more readily diſperſed.

With the exhibition of a briſk purge ſoon after, that will not inflame.] Thoſe medicines which are called purgatives, do not only evacuate thoſe humours, which before exiſted under the ſame form within the body, as they appear in at their diſcharge; but they alſo diſſolve the healthy juices, and evacuate them from the bowels when diſſolved, as was proved in the commentary on § 201. And from hence Eraſiſtratus and his followers rightly concluded, *Purgationes eſſe evacuationes una cum corruptione & immutatione illorum, quæ evacuantur:* "That purging is an "evacuation made with a corruption and alteration "of the humours evacuated." Galen [a] indeed eſpouſes the contrary opinion; but this ſeems to be truly the caſe. For ſcammony being given to the moſt healthy perſon, ſo diſſolves the ſound juices, that being melted into a thin water, they are diſcharged by ſtool in an incredible quantity; and if the uſe of the ſame medicine be frequently repeated, the whole body will be emaciated, the veſſels will collapſe, and extream weakneſs will follow. All which ſufficiently evince that the juices were not evacuated, as exiſting before in a morbid ſtate, but that the ſound humours are expelled from the body, after they have been diſſolved into a thin and fœtid water, by the force of the medicine. By theſe remedies therefore the veſſels are emptied, and the humours diſſolved, while at the ſame time the ſmall veins are rendered extremely bibulous; as they open throughout the whole external and internal ſurface of the body, which is evident from a remarkable experiment. A young man having a fever, attended with a diarrhœa and a great ſtupidity of his ſenſes, would not take any thing by

[a] Galen de purgant. Medicam. facult. cap. 2. Charter. Tom. X. pag. 464.

the

the mouth; though the fever in the mean time continued to dry up the body by its heat: hereupon the phyſicians ordered his feet to be immerged in warm water; which being done, a ſurpriſing conſumption of the water in the veſſel was ſpeedily obſerved, and ſoon after followed an impetuous diſcharge of the ſame water, almoſt uncoloured by the anus. Hence it is evident, that theſe purges very well ſatisfy the indications of the firſt and ſecond number of the preceding aphoriſm: for the humours are thus diſſolved, the veſſels evacuated, and that power encreaſed, by which the juices are abſorbed by the bibulous veins.

But it muſt be at the ſame time remarked, that thoſe ſtrong purges are not uſeful in this caſe, which act by exciting violent motion, ſuch as the colocynthis, euphorbium, *&c.* but ſuch only are here uſeful, as having a power to diſſolve the juices, do notwithſtanding produce their effects without much diſturbance; as ſcammony, jalap, leaves of ſena, *&c.* of which various forms are prepared in the *Materia Medica Booerhaaviana.*

Penetrating fomentations, *&c.*] As the extravaſated blood lies generally congealed, under the entire ſkin of the contuſed part; it ought therefore to be rendered fluid in ſuch a manner, as to prevent it from putrefying at the ſame time. Now congealed blood gradually diſſolves, barely by expoſing it to the open air, but then it alſo putrefies; and therefore it is neceſſary for theſe fomentations to have a power of reſiſting putrefaction, as well as of attenuating and diſſolving. Such a fomentation may be made of ſal ammoniacum, or ſea ſalt, diſſolved in twenty times as much water, with the addition of a fourth part of wine, and an eighth part of vinegar, which being applied warm, will anſwer all theſe intentions. For the water in it relaxes, while the ſalt, wine and vinegar, prove good diſſolvents, and at the ſame time prevent

[b] De Re Medica diſſertat. quatuor Thomæ Simſoni, pag. 183.

any

any putrefaction. The urine of a healthy person, mixt with a small quantity of vinegar, composes a fomentation of the like nature; with which those tumours of the head are happily discussed, which so frequently result from contusion in children.

Several medicinal simples may be also infused in the water, for this purpose, in which there is a power of dissolving; and the form of such a fomentation may be seen in the *Materia Medica* of our professor. Various emplaisters are also adapted to this intention, which may be seen enumerated in the *Materia Medica* corresponding to this aphorism. These last, while they adhere to the skin by their tenacity, restrain the most subtle juices from exhaling, and repel them in a manner to the part upon which they are applied; so that the part affected continues as it were in a bath of its own vapours, which relaxes the vessels; and then the aromatic or fragrant particles of the emplaister insinuating themselves into the relaxed vessels, frequently produce the desired effect, when fomentations are not so serviceable, unless they are continually retained warm upon the affected parts.

Warm frictions upon the part.] If no inflammation nor any great pain appears in the contused part, gentle frictions are extremely useful. For by this gentle agitation, the concreted blood is attenuated and divided, so as to be capable of returning through the small mouths of the bibulous veins. At the same time also the veins are thus emptied, so as to facilitate the motion of the absorbed humours through the depleted vessels, as we said before in the commentary to the preceding aphorism. Thus a man being abused by his enemies, had his whole face frightfully tumified by contusion, which was happily dispersed by these fomentations, joined with continual and gentle frictions, insomuch that no manner of suppuration followed in the tumour, and his face recovered its former shape, which could be hardly expected.

Inter-

Internal attenuating medicines, &c.] Thoſe medicines which reſtore the concreted parts of a fluid, to the ſame ſtate of fluidity which they poſſeſſed before concretion, are termed attenuants or reſolvents. Among theſe, warm water has the chief place; partly inaſmuch as it dilutes, by inſinuating itſelf betwixt the concreted particles; and partly, becauſe it is the vehicle that diſſolves all other medicines, concerning which you may conſult what has been ſaid before in the commentary on § 54. numb. 4. Phlebotomy therefore being premiſed, with the uſe of thoſe antiphlogiſtics or cooling purges, which powerfully diſſolve the humours, without putting them into any violent commotion; it will be next moſt convenient to give a large quantity of ſome decoction which contains much water, repleniſhed with ſuch particles, as may by a gentle ſtimulus excite the veſſels, to act a little more powerfully upon their contained juices; and alſo, that the unactive water may not be retained or accumulated within the body, obſerving likewiſe to chuſe ſuch ingredients as reſiſt putrefaction. Hence it is that the infuſion of ſcordium, rue, horehound, &c. with the five opening roots, the three ſorts of ſanders, nitre, honey, &c. are ſo very ſerviceable in theſe caſes. For when the veſſels, being firſt depleted by phlebotomy and the uſe of purges, are continually filled by drinking theſe decoctions warm, while at the ſame time the contuſed parts are continually treated with fomentations and gentle frictions, ſo as to derive the action of the internal medicines to the injured part, (for which ſee the commentary on § 134.) every thing is then done that can be expected from art. For then warm water, repleniſhed with the diſſolving virtues of the preceding remedies, will every moment be conveyed to the extravaſated humours, which will be thus diluted, diſſolved, and rendered fit to return into the ſmalleſt veins; ſo that all the extravaſated juices are thus carried off, without further injury, which is required by the intention.

But

But ſince all theſe remedies, taken in large quantities, are uſually again diſcharged from the body, either by a diaphoreſis, or by the urinary paſſages; therefore ſuch a diſcharge is to be performed, by a ſudorific regimen: as when a perſon is on all ſides encompaſſed with a warm atmoſphere, by lying in a bed, well covered, which will excite a ſweat; but if the patient remains in a cold air, that generally occaſions a more copious diſcharge by urine.

SECT. CCCXXXV.

THE order of which remedies, with the neceſſity of repeating them, and in ſuitable doſes, is determined by (334), with the dangerouſneſs of the caſe.

There is no neceſſity to uſe all theſe aſſiſtances of art, in every contuſion; for ſlight accidents of this kind may be removed barely by the uſe of fomentations, compoſed of urine, ſalt, vinegar, and the like: but when there is danger of a violent inflammation with the ſtoppage of the circulation, and a gangrene; then all the forementioned remedies are to be brought into uſe. In that caſe therefore we are to begin with phlebotomy, uſing it liberally, if the patient's ſtrength will permit; and in the next place to give the forementioned purgatives, that by diſſolving the humours, and weakening the vital powers, the body may be far from being inclined to inflammation or fever. If the tumour, pain, and inflammation do not yet diminiſh, by the uſe of theſe means, they are to be boldly repeated, eſpecially when the contuſion has injured ſome internal part; for then the worſt conſequences may be feared, from a ſuppuration, or elſe an incurable ſcirrhus may remain, from the imperfect cure of the diſorder, which may terminate in a cancer, and produce the moſt grievous ſymptoms.

toms. But when the ſymptoms diminiſh by the uſe of theſe means, then, if the affected part is acceſſible to the hand, gentle frictions will be extremely uſeful; and not before: for the tenſe and inflamed parts, diſtended by the extravaſated humour, may by a rough friction be rather excited to a ſpeedy gangrene.

SECT. CCCXXXVI.

AT the ſame time alſo a very thin diet, of aliments the leaſt apt to putrefy, is here required.

For the intention requires to dilute plentifully all the juices, and to ſupport life in ſuch a weak ſtate, that there may be no danger of inflammation; and as the extravaſated humours are ſpontaneouſly inclined to putrefaction, therefore a diet of ſuch aliments is to be choſe, as will reſiſt that kind of alteration in the juices. Hence a decoction of barley, oats, rice bread, and the like, in milk and water, with boiled apples, and other ripe garden fruits, are here highly recommended; alſo weak fleſh broths, boiled with rice or barley, and mixed with a little citron juice, are likewiſe equally ſerviceable. Nor is there any danger that this weak aliment will not be ſufficient to ſupport life; for the human body at reſt, may be ſupported even by the pooreſt nouriſhment. This is what the celebrated Boerhaave has experienced in himſelf, when being tormented by the moſt ſevere pains in a rheumatiſm, he lived for the ſpace of twelve days only upon whey; and yet he continued in good ſtrength, ſufficient for exerciſing the muſcles, if the pain had not oppoſed. But the body being weakened by bleeding, and the uſe of purges, cannot act ſo powerfully upon the ingeſted aliments, to change them into its own nature; whence the aliments will be more

more easily inclined to degenerate spontaneously according to their own nature. But as a putrefaction is to be feared in the extravasated juices, therefore such aliments are principally recommended in the diet, as have naturally a greater inclination to acidity; and for the same reason likewise, flesh, eggs, fish, and the like, are to be avoided. But all acrid sauces, spices, and the like, are pernicious, by increasing the motion of the circulation, which ought in this case to be rather weaker and more sedate. But in all these cases a regard must be likewise had to the season of the year, with the healthy or morbid constitution, and custom or course of life in the patient, *&c.* concerning all which you may consult what has been said in the commentaries on § 192 to 196.

If all that has been said concerning the diet and remedies afforded by pharmacy and surgery be duly observed, they will be always attended with success when the disorder is curable; but all other boasted specifics for contusions ought not to be trusted to alone for the cure of the disorder, though many of them are innocent, and may be used, provided the forementioned very efficacious means are not neglected. Thus Helmont * recommends the dried blood of a goat, that follows after cutting off his testicles, which he would also have to be given to such as fall from high places, in order to disperse the concreted blood in the contusion. Others recommend sperma ceti, a decoction of madder, *&c.*

SECT. CCCXXXVII.

BUT if the contusion is so large that it cannot be resolved, and is at the same time accessible to the hands, ascarification, incision, or suppuration must take place, observing what has been said in (334.) Or else, if the contusion is so

* Ortus Medic. in Capit. Pleura furens, pag. 322. nº. 32.

great as totally to deſtroy the life of the part, or is ſo conditioned, that one may thence certainly foreſee, that intolerable pains, inflammations, a ſuppuration, conſumption, fever, or death itſelf will follow, an amputation ought then to be timely made, when that is practicable, (464 to 475).

When the injury is ſo great that one can by no means hope to diſperſe the extravaſated juices, without further damage to the veſſels, the only remedy that then remains, when the contuſed part is acceſſible to the hand, is to make an opening for the diſcharge of the extravaſated juices, and then to deterge the parts by a mild ſuppuration, ſo as to reduce them to the ſtate of a clean wound. For if this method is not taken, the extravaſated juices compreſſing the adjacent veſſels, may occaſion an inflammation, or by wholly ſuppreſſing the vital circulation in the part, a gangrene may follow, which, if attended with a putrefaction, may occaſion ſtill worſe conſequences. In this caſe then the contuſed part is to be entirely divided, or elſe punctured in many places, by ſcarifying with a lancet, to give a free diſcharge to the extravaſated humours; and then the ſubjacent living parts, being ſet at liberty from the compreſſure, will expel and caſt off all that has been ſo injured by the contuſion, as to be no longer obedient to the laws of the circulation. But this ought more eſpecially to be performed, when very dangerous conſequences are to be feared from an inflammation or eroſion of the adjacent parts, as was obſerved before in the hiſtory of wounds in the head in § 243, 244, 248.

But notwithſtanding the difference of the caſe, the remedies mentioned in § 334. ought not to be here neglected; for if the inflammation proves too violent in the contuſed part, it may produce a gangrene inſtead of a laudable ſuppuration. Therefore phlebotomy and cooling purges are here highly uſeful,

ful, joined with those fomentations which restrain putrefaction: and at the same time it will be always useful to give large quantities of the attenuating decoctions, that all such parts of the corrupted juices or purulent matter, which have infected the mass of blood by returning through the bibulous veins, may be discharged from the body, either by a diaphoresis or the urinary passages. As it appears from what has been said before, that the extravasated blood may be so attenuated, as to be absorbed by the bibulous veins; so also may the matter or corrupted ichor return the same way, and infect the blood, so as to produce a very bad state of the juices; from whence again various bad consequences may follow.

But when a violent contusion has so injured the larger vessels, or has so far destroyed the fabrick of the part, that the vital circulation of the juices through the part is no longer continued, a perfect blackness or mortification thereof follows, which destroys them all. In that case there is but one remedy remaining; namely, to extirpate the part to preserve the life of the patient. That this is the state of the disorder, may be known, if no warmth nor any sensation remains in the contused part, even though it be deeply scarified; and a putrefaction speedily following affords a cadaverous smell. If now the part thus affected be not speedily extirpated, by the spreading of the sphacelus, the patient will be soon destroyed. Such a case happened to an expert coachman, who in breaking some unruly horses fell off of the chariot by their running away, whence his legs being unhappily twisted in the wheels were crushed to pieces in such a manner, that neither sense nor warmth any longer remained in the parts; but as this man would not admit them to be amputated, which was here absolutely necessary, he therefore expired on the fourth day after. The same is also true, if the bones are so fractured by a violent contusion, that they separate into small fragments or splinters, which, by pricking and

irritating the nervous parts, may produce the moſt ſevere pains, violent inflammations, and the bad conſequences which may thence follow. A man had his right hand ſo violently contuſed by the falling of a caſk of wine, that the bones of the metacarpus, which ſuſtain the index, middle, and ring finger, were cruſhed to pieces, together with the adjacent muſcles and veſſel. The celebrated ſurgeon employed affirmed, that there was no remedy remaining but an extirpation of the contuſed parts; and that if the operation was neglected, a train of the worſt ſymptoms would ſoon follow. But yet the wounded patient was unwilling to ſuffer the operation, and notwithſtanding the beſt remedies were applied for the ſpace of two or three days, the pains were very ſevere, the inflammation ſo violent, and the tumour ſo large, that it evidently appeared a gangrene would ſoon follow; but the contuſed parts being then immediately amputated, the patient was happily cured [a]. But how much may be effected, even in the moſt deſperate caſes, by an intrepid courage in the patient, with great ſkill and dexterity in the ſurgeon, may appear in the following hiſtory taken from the forementioned author [b]. A captain of a ſhip of war had his whole arm, by an unlucky accident, ſo miſerably contuſed, even up to the ſhoulder, that neither ſenſe nor warmth remained throughout the whole limb; and although a true ſphacelus had already ſpread itſelf beyond the ſhoulder, and the whole arm corrupted with a cadaverous ſtench, the ſurgeon confiding in his art, and the patient full of courage, preferred a doubtful remedy before certain death; whence the limb was immediately amputated in the articulation, and nature, being afterwards aſſiſted with proper remedies, ſeparated the reſt, which was already corrupted; ſo that in two months time he returned ſafe to his friends, ſnatch'd in a manner from the jaws of death.

[a] De la Motte Traité complet de Chirurgie, Tom. III. pag. 247.
[b] Ibid. pag. 408.

SECT.

SECT. CCCXXXVIII.

BUT more may be performed by the preceding method (331 to 336) than any one would imagine; becauſe nature herſelf is always ready to aſſiſt towards a ſpontaneous ſeparation, attenuation, reſolution, diſperſion, and expulſion in the parts injured.

But yet recourſe ought not to be had immediately to amputation, ſince the moſt faithful obſervations teach us, that ſuch diſorders have been ſometimes happily cured, though they have ſeemed altogether deſperate. Therefore it ſeems to be moſt adviſeable always to make trial firſt of the methods propoſed in the aphoriſms here cited, whenever that may be ſafely done; and in the mean time we are furniſhed with ſeveral remedies, by which the parts, even though mortified, may be ſo preſerved, that the putrefaction will not eaſily ſpread; ſuch as *alliaria*, *ſcordium*, *marrubium*, *ſalvia*, *ruta*, *&c.* which being infuſed in water, with the addition of ſalt, urine, and vinegar or ſpirit of wine, form a fomentation, which being applied warm both by day and night, certainly reſtrains all putrefaction; ſo that one may ſafely wait a few days to ſee whether nature will attempt a ſeparation, or whether any ſigns appear of life returning again into the part. Thus our celebrated profeſſor is uſed to tell his audience, that a German nobleman belonging to this univerſity was flung out of a chaiſe, and the wheels running over his legs, miſerably fractured the tibia and fibula of each leg, with a frightful laceration of the adjacent parts, which, though invaded by an incipient gangrene, were cured by the uſe of theſe remedies. There is alſo a ſurpriſing inſtance related in the obſervations of the celebrated Le Motte [a], of a young

[a] De la Motte Traité complet de Chirurgie, Tom. III. pag. 405.

man who received ſuch a violent blow upon the anterior part of his right arm, that a violent contuſion appeared to extend itſelf from the cubitus to the carpus, attended with extreme pain; the patient had applied linen cloths dipt in ſpirit of wine, but perceiving ſcarce any relief from thence, was obliged to have recourſe to a ſurgeon. The pain had now almoſt vaniſhed in the hand, but was more violent in the cubitus; the affected hand appearing pale and quite cold, and the ſkin being roughly handled, came off from the ends of the fingers. No pain was perceived in the hand, even by deep ſcarifications made with a lancet; nor did ſo much as a drop of blood follow, after thruſting a lancet quite through the hand; and this coldneſs and inſenſibility extended to the middle of the cubitus. The parts were fomented with ſpirit of wine mixed with ſalt and unguent. Ægypt. and at the ſame time a cataplaſm was applied compoſed of barley-meal, with the flower of beans and lupins, mixed with ſpices and wine; by the uſe of which remedies the warmth and ſenſation returned down to the carpus, the whole hand as yet remaining cold and ſenſeleſs; and though it had continued thus for the ſpace of five days, was neither fœtid nor black coloured. Scarifications being again made in the hand, warm oil of turpentine was afterwards applied, and then the other remedies as before for the ſpace of five days more without any alteration in the parts; but from that time the warmth and life began to return, and the patient was happily cured without any amputation, only two of the fingers remained afterwards contracted, with a ſtiffneſs in the reſt. Since therefore the contuſed part could be thus preſerved in ſo deſperate a caſe, it ſeems to be the duty of a prudent ſurgeon or phyſician not to have recourſe to amputation, unleſs all other means have been tried without ſucceſs. For if the force of the blood may be ſo abated by phlebotomy and the uſe of other remedies, that there is no danger of an inflammation or gangrene

grene from the contuſion, and at the ſame time ſuch applications are uſed externally, as reſtrain putrefaction, joined with a thin diet, not at all inclined to putrefaction, there is great room to hope that the corrupted parts will be ſeparated from the living, and that the loſt ſubſtance will be afterwards regenerated.

Of Fractures.

SECT. CCCXXXIX.

If the parts of a bone are violently ſeparated from their coheſion into large fragments, it is called a fracture.

Hitherto, we have been treating of a ſolution of continuity in the ſoft parts of the body, and we come now to conſider the ſame diſorder in the bones. But a ſolution of continuity in a bone is by the Latins diſtinguiſhed by the name of *fractura*, called by the Greeks [a] κάταγμα; though a ſolution of continuity made in the cartilages has never obtained a diſtinct name, but is comprehended under the title of fracture; at leaſt Hippocrates [b] uſes this name in treating of fractures in the joints, which are wholly cartilaginous, where he ſays, ἢν ὀ ἐς κατάαγῆ, &c.

But it is cuſtomary not to term every ſolution of continuity in a bone a fracture, but only that which is made by ſome external violence, as Ægineta [c] obſerves, where he ſays, *In univerſum autem fractura eſt divulſio oſſis, vel ruptura, vel diſciſſio à quadam vi externa facta*; "But in general a fracture is either a "divulſion, rupture, or cutting aſunder the parts of "a bone made by ſome external violence." For

[a] Galen. Meth. Med. Lib. VI. cap. 5. Charter. Tom. X. pag. 143.
[b] Hippoc. de Articulis, Text. 48. Charter. Tom. XII. pag. 361.
[c] Lib. VI. cap. 89. pag. 96. verſa.

thus a fracture is diſtinguiſhed from a caries of the bone. It is alſo added in this definition, that it is called a fracture when one part of a bone is ſeparated from its coheſion with the other, in order to diſtinguiſh it from a luxation, in which the naturally contiguous bones are removed from each other. But then to diſtinguiſh a fracture from a contuſion, which ſuppoſes a cruſhing of the ſolid parts (*vide* § 322.) it is added in the definition, that the diſorder is called a fracture, when the parts of a bone are ſeparated into *large fragments*. But notwithſtanding this, the antients refer a comminution of a bone into very ſmall fragments, to the head of fractures, provided it aroſe from ſome external violence; and ſuch a ſpecies of fracture they called ἀλφίτιδον [a].

SECT. CCCXL.

WHICH diviſion of the bone being ſingle, and by itſelf, denominates the fracture *ſimple*; but when there are ſeveral diviſions of the bone, it is a *compound* fracture; or if accompanied with a wound, contuſion, inflammation, an ulcer, or many fragments, it is then called a *complicated* fracture.

Surgeons uſually diſtinguiſh fractures into three ſpecies, *viz.* ſimple, compound, and complicated. A ſimple fracture is ſaid to be, when a ſingle bone is only fractured in one place, without any conſiderable injury of the incumbent parts adjacent. But when ſuch a fracture happens in any part of the body, where two large bones lie by the ſide of each other; as for example, in the cubitus; if the radius only is fractured, without injuring the ulna, that ſpecies of fracture is then termed incomplete, by ſome ſurgeons; becauſe the ſituation of the parts is not then much

[a] Lib. VI. cap. 89. pag. 66. verſa.

diſturbed,

diſturbed, and the limb retains its proper length: but when the ulna and radius are both fractured together, or the tibia and fibula in the leg, they then call the fracture complete, or even compound; though it would alſo ſeem that a fracture may be termed compound, when only a ſingle bone is fractured in ſeveral places. But when a fracture of one or more bones is alſo attended with ſymptoms that require a diſtinct treatment, ſuch as a wound, ulcer, *&c.* it is then termed complicated; becauſe a particular regard muſt be then had to thoſe concomitant diſorders, during the cure of the fracture. But it is very evident, that a fracture ought not to be termed complicated, unleſs thoſe ſymptoms are very ſevere; for no fracture can be made without ſome degree of contuſion, and a ſlight inflammation almoſt conſtantly attends a fracture. Hence it follows, that a fracture is only to be termed complicated, when thoſe concomitant diſorders are ſo conſiderable, as to require a diſtinct treatment, or a different method of cure from that which is ſufficient in a ſimple or compound fracture; as, for example, when a fracture is accompanied with a large wound, the ſame bandage cannot be applied as in a ſimple fracture, where the dreſſings may continue upon the part for ſeveral weeks; but ſuch an apparatus is required as may be eaſily removed, for the dreſſing of the wound, without hazarding a freſh diviſion of the fractured and reduced bone.

SECT. CCCXLI.

NOW according to the different courſe of the fracture, it is alſo termed, either tranſverſe, oblique, or longitudinal; and according to the fragments, pointing againſt, or preſſing laterally upon each other; and according to the protuberant ſpines that ariſe, the fracture takes a different

different name and method of cure, as it requires a differene nature.

Fractures again acquire different names according to their different courſe or ſituation. A tranſverſe fracture is when the bone is divided in a direction perpendicular to its length, being that ſpecies of fracture which our ſurgeons in Holland called *radyſbreuk*, or a breaking ſhort off like a ſtick; and the like term we alſo meet with among the antient Greeks, taken from the ſimilitude of a broken ſtick or ſtalk, *viz.* καυληδὸν κάταγμα [a]; namely where the parts of the bone tranſverſely fractured, entirely depart from each other, without any further coheſion. Hence this kind of fracture is alſo termed ραφανηδὸν and σικυηδὸν by Ægineta [b], from the ſimilitude of a broken radiſh or cucumber. Hence alſo Hippocrates [c] ſeems to have uſed in the ſame ſenſe the word ἀποκαυλισθῆναι, where he ſays, ἢν δὲ καταλῇ ἡ κάτω γνάθος, ἢν μὴ ἀποκαυλισθῇ παντὰπασιν, ἀλλὰ ξυνέχηται τὸ ὀστέον, &c. *Si vero inferior maxilla frangatur, nec autem omnino tranſverſim fracta fuerit, ſed cohæreat os, &c.* "But if the lower jaw is "fractured, the fracture not being quite tranſverſe, "but the bone yet adheres, &c." where it manifeſtly appears, that τὸ ἀποκαυγισθὲν is uſed in oppoſition to τῷ συνεχεῖ.

Oblique.] Namely, when the diviſion of the bone is not perpendicular to its length, but inclined either to one ſide or the other; by which means the fracture acquires a larger ſurface, and the fragments are more difficultly retained together, after they have been reduced.

Longitudinal.] Namely, when the bone is ſplit according to its length, whence it may be rather termed a fiſſure than a fracture; becauſe the parts of

[a] Galen. Method. medendi, Lib. VI. cap. 5. Charter. Tom. X. pag. 143.
[b] Lib. VI. cap. 89. pag. 96. verſa.
[c] De Articulis Textu, XXV. Charter. Tom. XII. pag. 342.

the

the affected bone are in this caſe ſeldom entirely ſeparated from each other, but remain ſlit as it were in a right line, which ſpecies of fracture is therefore called by the antients χιδαχνδὸν, or a diviſion of the bone according to its length [c].

According as the fragments, &c.] For the fractured extremities of a bone may either continue in their natural ſituation, eſpecially when the fracture is tranſverſe; or elſe they may be a little diſplaced, ſo, however, as to remain partly in contact with each other; or laſtly, the fragments may be wholly ſeparated from each other, and recede to either ſide, which is almoſt conſtantly the caſe in oblique fractures, and ſometimes alſo in tranſverſe; but if the fragments are alſo ſharp pointed, they may run through the integuments like thorns, which is certainly the worſt ſpecies of fractures.

But it is neceſſary to attend carefully to all theſe different circumſtances, not only for diſtinguiſhing fractures by their different names, but becauſe their different nature requires a different treatment, and a better prognoſis may be thence formed of the bad conſequences which may be expected to follow.

SECT. CCCXLII.

THE effects of a fracture are different, according to the particular nature of the fractured bone, and the different manner in which the fracture is inflicted, with the various condition of the fragments, as to their ſituation, figure, number, magnitude, &c. and laſtly, according to the different nature of the adjacent parts, and of the part itſelf, in which the fracture happens.

[d] Galen de Method. medend. Lib. VI. cap. 5. Charter. Tom. X. pag. 143.

[e] Ægineta, Lib. VI. cap. 89. pag. 96. verſa.

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The firſt conſequence of a fracture, is an injury of all the functions which reſulted from the continuity of the bone, and then follows a diſturbance in the actions of the adjacent parts, which are either compreſſed or injured by the bony fragments. Hence it is very evident, that a great variety of ſymptoms may follow, from a fracture as the cauſe; and the difference of theſe ſymptoms will depend on,

The particular nature of the fractured bone.] As for example, the larger bones, ſuch as the os femoris, os humeri, *&c.* have a cavity in which the medulla is depoſited, but the clavicles, ribs, bones of the carpus and tarſus, have no ſuch cavity full of marrow; whence a fracture of the larger bones muſt be always attended with an injury of the medulla, from whence the very worſt conſequences may follow.

The different manner in which the fracture is inflicted.] For a tranſverſe fracture is the beſt, ſince the parts may be mutually applied to each other; but an oblique fracture is worſe, becauſe the extremities of the fractured bone more eaſily depart the one from the other. Whence Hippocrates[a], in treating of a fracture in the clavicle, obſerves that it may be more eaſily cured if fractured quite tranſverſely; but more difficultly, if it is broke in a longitudinal direction. The difficulty of the cure will be alſo much augmented, if the fracture is accompanied with a violent contuſion or wound.

Various condition of the fragments as to their ſituation, *&c.*] For when the ends of the bone remain in their proper ſituation in a tranſverſe fracture, they do not injure the adjacent parts; or when they depart a little to either ſide, but in ſuch a manner that the lower end as yet ſuſtains the upper, there are no very bad conſequences thence following. But when the ends of the bone, being removed from their natural ſituation, are forced up by the ſides of each other, they will neceſſarily preſs and injure the ad-

[a] De Articulis Tex. LXIII. Charter. Tom. XII. pag. 323.

jacent

jacent muſcles, tendons, &c. and a much greater extenſion will be here required to reduce the fractured ends of the bone again to their natural ſituations.

Figure.] For the more acute the fragments, the more will they injure the adjacent parts; whence Celſus[b], in treating of the various kinds of fractures, pronounces, *Omne igitur os, modo rectum, ut lignum in longitudinem finditur: modo frangitur tranſverſum: interdum obliquum: atque id ipſum nonnunquam retuſa habet capita, nonnunquam acuta, quod genus peſſimum eſt: quia neque facile committuntur, quæ nulli retuſo innituntur; & carnem vulnerant, interdum quoque nervum aut muſculum:* "Every bone is therefore fractured, ſome-"times in a right line, like a piece of wood that is "ſplit longitudinally; ſometimes it is broke in two, "tranſverſely, and ſometimes obliquely; ſometimes "alſo the extremities of it are obtuſe, and ſometimes "acute, which laſt is the worſt kind of fracture; be-"cauſe the ends cannot be reduced together, having "no ſupport for each other, and becauſe they wound "the fleſh, or ſometimes injure the nerves or muſ-"cles."

Number, magnitude.]. The more numerous the fragments into which the fractured bone has been ſeparated, ſo much the more danger is there of injuring the adjacent parts, and the more difficult will it be to retain the reduced bones in their natural ſituation: but the larger the fragments, the cure will be *(cæteris paribus)* ſo much the more eaſy.

According to the different nature of the adjacent parts, or of the part itſelf, &c.] The larger bones are very compact in the middle, but at their articulations their ſubſtance is ſpongy or cellular, formed by the departing of the bony lamellæ from each other: if therefore a bone is fractured near its articulation, it muſt of neceſſity deſtroy this cellular fabric; whence a great number of diſorders may follow from the humours there extravaſated and corrupted. But the li-

[b] Lib. VIII. cap. 7. pag. 524.

gaments

gaments which connect the bones to each other, being inſerted near their articulations, they will be likewiſe injured; whence an inflammation of them, and an anchyloſis may follow. It was ſaid before in the commentary on § 218. numb. 6. that a very conſiderable artery enters the tibia, through its upper and back part, frequently running for the length of an inch, in the midſt of the ſubſtance of the bone itſelf: if therefore a fracture ſhould happen in that part of the bone where the artery enters, a fatal hæmorrhage may follow, if the fracture is alſo accompanied with a wound; or elſe the blood, extravaſated under the entire ſkin, may produce a ſpurious aneuriſm, and all the bad conſequences that may thence follow.

If again the fractured parts are within the reach of a conſiderable nerve, artery, or vein, which run near the bone, it is very evident in what danger they are of being compreſſed or injured by the fragments, eſpecially when they are ſharp. Many bad conſequences are alſo to be feared, if the tendons of ſtrong muſcles are inſerted into the part of the bone fractured. All theſe circumſtances are to be conſidered at the firſt dreſſing, and therefore the ſurgeon and phyſician ought not to proceed too haſtily, but to conſider well the nature of the part fractured, and compare it with thoſe excellent tables of Euſtachius; for unleſs the conſequences to be feared are then predicted, they may be afterwards imputed to a miſmanagement of thoſe who are employed in the cure; thus, for example, a fracture of the os humeri near its articulation, by compreſſing or injuring the large nervous trunk there ſeated, may produce a palſy, a loſs of ſenſation, or a withering, *&c.* of the limb, which can be remedied by no means whatever. Hippocrates[c] alſo diligently inculcates this admonition, in treating of thoſe fractures where the fragments are forced through the ſkin; where he ſays, *Quibus vero femoris vel humeri os exceſſit, fere non evadunt, ſunt enim oſſa hæc magna,*

[c] De Fracturis Textu, XLVII. Charter. Tom. XII. pag. 257.

magna, & multum medullæ habent, & multa ac magna ſimul lacerantur, nervi, & venæ & muſculi. Quod ſi reponantur, ſolet nervorum diſtenſio ſupervenire; ſi non reponantur, febres acutæ & bilioſæ, & ſingultuoſæ, &c. Magis adhuc evadunt, quibus inferior pars oſſis, quam quibus ſuperior exceſſit, &c. Multum quoque differt, ſi verſus interiora os brachii vel femoris exceſſerit: multæ enim et magnæ venæ per interiorem partem feruntur, quarum nonnullæ vulneratæ hominem jugulant: per exteriorem vero partem pauciores incedunt. In ejuſmodi ergo læſionibus non oportet obliviſci periculi, illudque in tempore prædicere: "But thoſe who have a fracture of the os "femoris or os humeri very difficultly eſcape; for "thoſe bones are very large, contain much marrow, "and at the ſame time lacerate many and large nerves, "blood-veſſels, and muſcles. Even if they are re-"duced, a convulſion uſually follows; and if they "are not reduced, acute and bilious fevers, with hic-"cups, &c. enſue. But thoſe are ſtill more likely to "eſcape, where the fracture is in the lower part of the "bone, than when it is in the upper part, &c. The "caſe will be alſo much worſe, if the fracture of the "os femoris or os humeri turns inward, becauſe many "and large veſſels run by the inner ſide of the bone, "ſome of which being wounded kill the patient, but "along the outer ſide of the bone there are few veſſels "placed. In fractures of this kind therefore the dan-"ger ought to be remembered, and timely pre-"dicted." Thus the worſt conſequences frequently follow after a fracture of the ribs, when the fragments lacerate the pleura, or even ſometimes wound the lungs themſelves, whence an empyema, and an incurable conſumption, thence following. And a fracture of the calcaneum, into which is inſerted the very ſtrong tendon termed Achillis, is often followed with moſt acute and continual fevers, accompanied with a trembling, hiccup, and delirium, which deſtroy the patient in a few days [d].

[d] De Fracturis Textu, XXIII. Charter. Tom. XII. pag. 201.

SECT.

SECT. CCCXLIII.

THE chief conſequences are therefore a deſtruction of the office of the bone, for ſuſtaining or ſupporting and directing the muſcles; whence a contraction of the muſcles, a diſtortion of them from their proper places, with a ſhortening, diſtortion, and deformity of the limb itſelf; a laceration, contuſion, and corruption of the external and internal perioſteum, of the veſſels themſelves ſeated in the ſpongy part of the bone, and alſo of the medulla with its including fine membrane; a luxuriancy of the veſſels of the bone, whence a rough callous tumour, and deformity of the limb; a diſtraction, laceration, irritation, compreſſion, and convulſion of the membranes, tendons, and nerves: an injury, obſtruction, inflammation, and deſtruction of the adjacent veſſels, pain, ecchymoſis, withering, ſuppuration, gangrene, and death itſelf, of the part or of the whole body; but a contuſion almoſt conſtantly attends a fracture.

This aphoriſm enumerates the principal diſorders which uſually follow after fractures of the bones.

A deſtruction of the office of ſupporting.] When we either ſtand or walk the whole weight of our body is ſuſtained by the bones of the thighs and legs; whence it is, that theſe bones, being too flexible in rickety children, are incurvated by the incumbent weight of the body. When therefore the continunity of the bone is removed by a fracture, this office of ſuſtaining the body is immediately removed, unleſs the fracture ſhould happen to be tranſverſe, ſo that the ends of the bone, as yet retaining their natural places,

places, are ſuſtained the one upon the other; but if in ſuch a caſe the perſon walks, or moves the fractured parts, the ends of the bone will ſoon after be removed from their contact, and be incapable of ſuſtaining the weight of the body. Parey[a] being ſtruck by the kick of a horſe, fell down in his endeavouring to avoid farther injury, and both bones of his left leg being fractured, forced themſelves not only through the ſkin, by the preſſure which they received from the incumbent weight of the body, but they alſo perforated the boot itſelf, with intolerable pain.

Of ſuſtaining and directing the muſcles.] Moſt of the muſcles in the body ariſe from, and are inſerted into the bones, ſo that, if we except the ſphincters, and muſcular fibres of the veſſels and viſcera, we ſhall ſcarce find any muſcle, but what has one end of it faſtened to ſome bone. The bones therefore being fractured, the action and direction of the muſcles faſtened to thoſe bones will be deſtroyed, or wonderfully perverted. When the patella is fractured, to which adheres the tendons of the muſcles extending the leg, the direction and action of thoſe muſcles is then immediately diſturbed; becauſe it ſerves as a ſupport to elevate and ſuſtain their tendons. The ſame is alſo true of the other bones.

A contraction of the muſcles, and a ſhortening of the limb.] Galen[b] had in his time obſerved, that the muſcles had in them a natural power of contracting themſelves; and that this contraction did not proceed from the faculty of the mind, which moves the muſcles, he proves by an experiment, *viz.* That a muſcle tranſverſely divided appears to contract itſelf towards each end, even after death. Veſalius[c] has beautifully confirmed the ſame thing by experiments made on living animals; for when he totally divided the belly of a muſcle, he obſerved that one part of

[a] Livre XV. Chapitre 23. pag. 344.
[b] De motu muſcul. Lib. I. cap. 8. Charter. Tom. V. pag. 376.
[c] Lib. VII. cap. 19. pag. 568.

the muſcle contracted itſelf towards its origin, and the other part towards its inſertion; and upon dividing the tendon of another muſcle, he perceived that the muſcle contracted towards its origin; or if he divided the head of the muſcle, it contracted towards its inſertion. But when he divided the muſcle both at its origin and inſertion, it then contracted towards its belly, and became globular in that part which was moſt fleſhy. But it is the bones, to which the muſcles are attached, which maintain them in this diſtention; ſo that when a bone is broken, the muſcles become ſhorter by a ſpontaneous contraction, and draw up that part of the bone into which they are inſerted; whence the limb becomes ſhorter, in proportion as the muſcles, inſerted into the lower fragment of the bone, are more ſtrong and numerous. Thus if the os humeri is fractured above the place into which the deltoide muſcle is inſerted, it will be then contracted very ſtrongly upwards; whence the arm will become ſhorter: for as Celſus [d] obſerves, *Nam nervi muſculique, intenti per oſſa, contrahuntur:* "The nerves and muſcles, which are kept in a ſtate "of tenſion by the bones, are then contracted." The ſame is alſo true of a fracture in the os femoris, whence is is unanimouſly allowed by the conſent of all ſurgeons, that a fracture in the upper part of the thigh bone, near the hip, is ſeldom curable, without leaving ſome defect in the motion of the limb; but when the ſame bone is fractured in the middle, or towards the knee, there are much greater hopes of obtaining a happy cure. This ſeems to follow, becauſe the higher the fracture of the femur, the greater number of muſcles draw up the lower part of the bone; and as thoſe muſcles are very ſtrong, they require a very forcible extenſion, in order to replace the fragments, which are then alſo very difficultly retained in contact.

[d] Celſus, Lib. VIII. cap. 10. pag. 532.

A diſ-

A diſturbance of the muſcles from their proper ſeats.] Moſt of the muſcles ariſe from and are inſerted into the bones, and frequently adhere for a very conſiderable length to the bones; if therefore a fractured bone ſhould happen to be diſplaced, it will diſturb the ſituation and courſe of the adjacent muſcles, which ariſe from or are inſerted into the fractured bone; and beſides this, the fragments of the bone may diſturb other muſcles, which neither ariſe from nor are inſerted into the bone fractured; inaſmuch as the fragments will expel and diſplace all the circumjacent ſoft parts, which cannot be performed without a diſturbance of the muſcles, whence will follow,

A diſtortion and deformity of the limb.] The external ſurface of the human body is beſet with various eminences and excavations, which ariſe principally from the muſcles variouſly placed, and being either contracted or relaxed, which is more eſpecially obvious in robuſt men who are not over fat; but in women they are leſs conſpicuous, whoſe bodies are therefore always more ſmooth and even. This is very well expreſſed by the painters and ſtatuaries, when they repreſent the bodies of Hercules or Laomedon with ſtrong arms, or the body of Venus ſmooth and uniform. So ſoon therefore as the muſcles are diſplaced by the fracture of a bone, the figure of the parts is altered, and the natural ſhape of the limb is deſtroyed. Hence it is that ſkilful ſurgeons compare, for example, the arm or leg which was broken, with the arm or leg of the ſound ſide; and by a ſtrict attention they obſerve, whether both limbs have the ſame eminences and excavations, in order to determine whether the fractured bone is properly reduced. For the fragments of a bone, for example, of the humerus may be adapted to each other, and cohere together, though they are not replaced in the ſame poſture which they had naturally before; but then the deformity of the limb, in this caſe, will always demonſtrate the error. The greateſt deformity of this

kind, may follow after a fracture in the bones of the cubitus; for then the ſupinator and pronator muſcles of the hand, commonly alter the natural figure of the parts in a ſurpriſing manner.

We come now to the diſorders which happen to the bones themſelves, after a fracture.

Of the external perioſteum, the veſſels running betwixt the bony cells, the internal perioſteum, the membranes of the medulla, *&c.*] All the bones are inveſted with a membrane, which conveys veſſels to and from the ſubſtance of each bone, and which is termed the perioſteum, generally adhering very ſtrictly to the bones. This membrane covers the external ſurface of the bones on all ſides, except in thoſe places where the ligaments ariſe from the bones, to inveſt and ſecure the articulations; for in theſe places the perioſteum departs from the bone, and continues to run on over the ligaments, till it is inſerted into and conjoined with the next bone; and in this manner does the perioſteum paſs from one bone to another, without any interruption of its continuity[c]. The whole ſurface therefore of all the bones is covered with the perioſteum, excepting thoſe parts which are contained in the capſule of each joint, ariſing from the ligaments of each articulation. But it very rarely if ever happens, that the bones are broke within theſe ligamentary capſules, whence a fracture of the bone muſt always injure the external perioſteum. Add to this, that we meet with a very ſurpriſing cellular fabrick in many of the bones; and the ſmaller bones which have no large cavity filled with marrow, ſuch as the bones of the fingers, metacarpus, and carpus, *&c.* have their whole ſubſtance compoſed of bony cells. But in the larger bones, which have a conſiderable cavity in their middle filled with the medulla; theſe have their bony lamellæ very compact and cloſely united in the middle, but towards the ends of the bone they recede from each other, and form

[c] Clopton Havers Oſteologia nova, pag. 17.

wonder-

wonderful cells, in which the blood veſſels and veſicles of the medulla are depoſited. If therefore one of theſe larger bones is fractured at its extremities, this cellular fabrick will be deſtroyed, the veſſels will be ruptured, and their juices extravaſated; which by corrupting may produce a train of the worſt conſequences. Hence it is eaſily apparent, that a fracture of the bone may alſo deſtroy the internal perioſteum with the fine medullary membrane, and the ſubſtance of the medulla itſelf; ſince theſe are ſo tender, that they break to pieces with a rough handling with the fingers, even in an old ox. But where ſevere maladies may follow from a corruption of the medullary oil, we ſhall hereafter declare more at large in the hiſtory of diſeaſes in the bones. But certain it is, that all thoſe parts will be lacerated, if the ends of the fractured bone recede from each other, or ride over the one upon the other; for then all the parts contained within the cavity of the bone muſt be unavoidably lacerated. It is indeed true, that the worſt conſequences, which are to be thence feared, do not always happen after a fracture; but it is evident, that they may ſometimes follow, and therefore it is moſt adviſeable for the ſurgeon to acquaint the patient, or rather his friends, that ſuch accidents may happen; by which means he will prevent them from being aſcribed to any want of ſkill or care in himſelf.

A luxuriancy of the veſſels of the bone, whence an inequality of the callus, with a tumour and deformity of the limb.] In the Prænotiones Coacæ of Hippocrates[h] we meet with the following ſentence, *Quodcunque os in corpore reſectum fuerit, aut cartilago, non augetur*; "Whatever bone or cartilage in the body "is divided, it will not grow or be nouriſhed;" and in the aphoriſms he ſubjoins alſo, *nec coaleſcit*, "that "it will not unite or coaleſce[i]." After him Galen has alſo pronounced, that a bone can never unite

[h] N° 505. Charter. Tom. VIII. pag. 882.
[i] Sect. VI. Aphor. 19. Charter. Tom. IX. pag. 258.

with bone, nor cartilage with cartilage; for in a fractured bone there is an union of the parts by the intervention of a growing callus like glue, but not by a concretion of the divided parts themſelves [k]. But in his firſt commentary which he has writ upon Hippocrates concerning fractures, he has explained this matter more at large [l], where he ſays, *Quum oſſa ob ſiccitatem naturalem non poſſint carnis inſtar coaleſcere, quaſi vinculum quoddam illorum callus fit, circumcreſcens fracturæ labiis. Originem vero ei (callo) dat ſuperfluum ipſius oſſis fracti nutrimentum. Et quando decumbens non utitur idonea victus ratione, vel etiam plethoricus eſt, illud ſuperfluum copioſum eſt, effuſumque totas facias velut effuſo ſanguine madefacit*; "As the bones "by their natural dryneſs cannot grow together like "fleſh, therefore a callus growing round the margin "of the fracture forms a ſort of vinculum or con-"nexion. But the origin of this callus is from the "ſuperfluous nouriſhment of the bone itſelf; and "when the patient does not uſe a proper regimen, or "is of a plethoric habit, that ſuperfluous nouriſh-"ment is very copiouſly diſcharged, ſo as to wet or "moiſten all the dreſſings or bandages in the manner "of extravaſated blood." From hence he ſeems to think, that the callus does not ariſe from the proper ſubſtance of the bone itſelf, but that the bone is conjoined by the intervention of a kind of glue, interpoſed betwixt the fragments; for a little afterwards he ſubjoins, *Quale enim unitis lignis gluten eſt, tale oſſibus fractis callus*; "For the callus is to fractured bones "the ſame as glue to pieces of wood united." But ſince it cannot be denied, that the callus in time acquires the ſame hardneſs with the bone itſelf, and as Galen did not believe a callus to be capable of puting on the nature of bone, it ſeems ſurpriſing when he expreſſes himſelf in the following words: *Quidquid igitur ex eo, dum effunditur, circa fracturæ labia con-*

[k] Galen de Meth. Med. Lib. V. cap. 7. Charter. Tom. X. pag. 113.
[l] Charter. Tom. XII. pag. 179.

creſcit,

creſcit, illud, tempore mutatum ab oſſe contiguo, illi ſimillimum fit, & callus nominatur; "Whatever then "concretes about the margin of the fracture, while "it tranſudes from thence, the ſame being changed "by time, becomes very much like the bone itſelf, "and is denominated a callus." Whence it appears, that he would have the name of callus continued, even after it has acquired the hardneſs of a bone. After Galen, moſt people ſeem to have been of the ſame opinion. But we have already ſeen in the commentaries on § 158. numb. 9. that the loſt ſubſtance is regenerated in wounds, and the divided parts united, not by the intervention of glue, but by a true regeneration of the loſt fleſh, formed by nature from good blood brought to the parts; as Galen himſelf has truly affirmed in the place there cited. It alſo evidently appears in the hiſtory of wounds in the head, that the part of the ſkull, which is removed by the wounding inſtrument, or cut out by the trepan, grows up again. The ſame therefore ſeems to take place in fractures of the bones, namely, that they conjoin not by the interpoſition of any glue, but by a ſubſtance truly of their own; and in thoſe caſes, where part of the bone is removed, there is not a thick humour interpoſed betwixt the fragments, which gradually hardens, but the organical fabrick of the bone itſelf is reproduced, and repairs the loſt ſubſtance. This truth is very well confirmed by chirurgical obſervations. A man being loaded had the tibia and fibula fractured by a cart-wheel paſſing over his leg, which lacerated all the adjacent parts in ſuch a manner, that nothing leſs than an amputation of the limb could be thought of. But the fragments of the bones being replaced, and proper means uſed, the fibula was perfectly united after two months time; but a conſiderable fragment of the tibia was ſeparated to the length of four fingers breadth, in which the groove of the medullary cavity was conſpicuous; ſo that a large hiatus or ſpace was left betwixt the two

ends of the fractured tibia. But yet this whole ſpace was in ten months time filled with a ſubſtance ſo compact and firm, that the man could afterwards commodiouſly uſe his leg [m]. But does it ſeem credible, that a glue, ariſing from the ſuperfluous nouriſhment of the bone, and tranſuding from its own fractured extremities, could thus elongate the bone exactly without any deviation, ſo as to fill up ſo large a ſpace? Or rather ought not this to be aſcribed to that wonderful property received by the human body from its adorable Creator, by which it is able to reſtore the loſs of ſubſtance, and increaſe the dimenſions of all its parts already formed by changing its aliments into its own nature through the action of the veſſels and viſcera? Certain it is, that the vital rudiments concealed in the ſacculus of colliquamentum in a fecundated egg, does in the ſpace of one and twenty days build up the whole created fabrick of its little body, and forms ſuch ſolid bones from the ſoft albumen, as not only enables the chick to ſtand, but alſo to run about ſoon after it is hatched. The ſame mechaniſm therefore ſeems to take place in the bones, with reſpect to the reproduction of their loſt ſubſtance, and their concretion after a fracture, as we obſerve to happen in wounds of the ſoft parts; namely, that there is an organical reproduction of the loſt ſubſtance, and a true concretion without any agglutination by the interpoſition of a ſhapeleſs glue.

Now as in wounds of the ſoft parts the repullulating veſſels, which are ſo minute and ſoft, may be too much diſtended for want of the confining ſkin, ſo as to degenerate into a fungous fleſh; the ſame is alſo true with reſpect to the callus of a bone, which may be luxuriant in the ſame manner, if the juices are diſcharged too copiouſly, or if the veſſels are too forcibly diſtended beyond what is neceſſary for reproducing the ſubſtance of the bone, and this is more

[m] Traité complet de Chirurgie, par M. de la Motte, &c. Tom. IV. pag. 284, &c.

eſpecially

eſpecially to be feared in younger ſubjects, whoſe ſolids are always more weak and infirm, and their fluids more redundant, and generally move with a quicker circulation. From hence it is, that ſurgeons have ſo often obſerved a luxuriancy of the callus in young patients, eſpecially after uſing a plentiful diet; but then this accident muſt be neceſſarily attended with an inequality and alteration in the figure of the part. But the deformity of a limb happens ſtill more frequently, when the two ends of the fractured bone are preſſed againſt each other before the callus has acquired ſufficient firmneſs; for then the callus is preſſed out on all ſides like ſoft wax, and forms a protuberant ring round the fractured part of the bone. This accident alſo more eſpecially happens when the patient walks too ſoon upon the fractured bones either of the legs or thighs; for the weight of the body preſſing on the bones forces out the callus, if it has not yet acquired its bony hardneſs.

A diſtraction and laceration of the membranes, tendons, and nerves.] Which more eſpecially follow, when the ends of the bones ride over each other, and ſtill more if the ends of the fragments are ſharp pointed; for then they prick and lacerate all the circumjacent parts. It has been obſerved under the preſent aphoriſm, that when Parey had the misfortune of his leg broken while ſtanding on it, the fragments of the bone not only pierced through the ſkin and muſcles, but even through the boot alſo with intolerable pain. But what dangerous conſequences are to be feared, from the membranes, tendons, and nerves being injured or irritated, has been already ſaid in the commentaries on § 162 to 166, and 181 to 185. Such lamentable conſequences ſometimes follow in theſe caſes, that Hippocrates adviſes the phyſician to avoid them, when he can do it without prejudice; ſince there are here but few hopes and the greateſt danger: [p] *Si enim non reponantur oſſa, medicus videtur*

[p] Hippocrat. de fracturis, Text. L. Charter. Tom. XII. pag. 259.

arte

arte deſtitui, ſi reponantur, homini magis ad interitum, quam ad ſalutem eſt; "For if the bones are not re-" placed, the phyſician will ſeem incapable of his " art; and if they are replaced, the patient will be " advanced nearer to death than recovery."

An alteration and deſtruction of the adjacent veſſels.] The worſt accidents, that uſually follow fractures, ſeldom proceed from the injury of the bone itſelf, but rather from the injury offered to the adjacent ſoft parts, which are compreſſed or wounded by the bony fragments. Great numbers of veſſels then are injured, which are either ſeated in the ſubſtance of the bone or in the adjacent parts, liable to be compreſſed or injured by the diſplaced fragments; whence Hippocrates obſerves, (as we ſaid under the preceding aphoriſm,) that it is of great moment to know, whether the bones of the arms and thighs are diſplaced inwards or outwards, becauſe many and large veſſels run along the inner ſides of thoſe bones. Among the cauſes of obſtruction (§ 112.) we enumerated every thing capable of rendering the flexible canals narrower by an external compreſſure or extenſion; it is therefore evident, that obſtructions muſt frequently follow fractures of the bones. And though the courſe of the humours through the narrow veſſels be not totally intercepted, yet many of the functions of the body may be thence ſurpriſingly diſturbed various ways; ſince the due performance of thoſe functions reſult in a great meaſure from the juſt proportion of amplitude, which the trunks and branches of the veſſels have with reſpect to each other. If now to an obſtruction of the veſſels we add an increaſed circulation of the humours ariſing from a fever, an inflammation will be formed, which may produce all its conſequences, as ſuppuration, gangrene, ſphacelus, *&c.* The ſevere pains alſo in fractures ariſe, not ſo much from the injury of the bone, as from the great diſtention of the membranes, tendons, or nerves; as may in a great meaſure appear from the entire ceſſation or great

great diminution at leaſt of the pains, after the bones have been reduced into their natural ſituations. When veſſels are divided under the entire ſkin, or but ſlightly wounded, the blood eſcapes, and being collected in the panniculus adipoſus, forms an ecchymoſis, as we obſerved in the hiſtory of contuſions. But when the trunk of a large artery or nerve, deſcending to the ſubjacents, is ſo compreſſed or injured that it can no longer tranſmit any thing, the ſubjacent parts are then deprived of all vital influx, and are either corrupted with a gangrene, or are ſlowly dried up or withered; as appears from the remarkable caſe we related of the man, who had the trunk of the axillary artery totally divided, whence his arm remained all his life-time afterwards dried up like a mummy. See the comment on § 161.

But death ſometimes follows fractures of the bones, from the excruciating pains, ſevere fever, delirium, convulſions, *&c.* or if a gangrene invades the injured part, which turning to a ſphacelus, aſcends to the ſuperior parts, and after reſtleſſneſs, delirium, ſyncope, hiccups, *&c.* the patient at laſt expires in a pleaſant ſleep.

Almoſt conſtantly a contuſion.] For the external violence cannot diſſolve the continuity of the bone, unleſs it alſo acts upon the ſoft parts incumbent on the bone; and theſe ſoft parts being preſſed betwixt the hard bone and the injuring cauſe, muſt neceſſarily be contuſed. There will be therefore always ſome contuſion in every fracture, unleſs the bones become ſo friable by the venereal diſeaſe, the rickets, ſcurvy, or the like, that they may be fractured by a very ſlight force. But this is a ſymptom that ought always to be well conſidered in fractures, for there are many bad conſequences which ariſe from the contuſion, even after the bone has been happily replaced: whence Hippocrates * (enumerating many of the accidents which follow uſually from fractures and luxations)

* Textu LXII. Charter. Tom. XII. pag. 268.

lay

lays it down for a general axiom, that more is to be feared from the contuſion than from the fracture itſelf. For he ſays, *Leviora autem, ut ſummatim dicantur omnia, ſunt vitia, quibus oſſa franguntur, quam quibas oſſa quidem non franguntur, venæ autem & nervi natabiles conteruntur in iiſdem locis. Hæc enim hominem magis ad interitum præcipitant, quam illa, ſi continua febris acceſſerit:* "For the ſymptoms are in ſhort all "of them ſlighter when the bone is broke by the "force, then when it remains whole, for the conſi- "derable veſſels and nerves are cruſhed in thoſe "places, where the injury is received: and this con- "tuſion accompanied with a continual fever, hurries "the patient to his end ſooner than a fracture." Therefore thoſe remedies are often neceſſary to be uſed in fractures which are proper in the cure of contuſions. For though the juſt replacing of the fragments, and the retention of them in their proper places, ſeems to ſatisfy the firſt or general intention, and may appear of themſelves ſufficient in the judgment of many ſurgeons, yet it is very apparent from what we have before ſaid, that a different method of treatment will be required according to the various accidents which accompany the fracture.

SECT. CCCXLIV.

FROM a conſideration of all which (342, 343.) we are informed of the exiſtence and nature of a compound fracture: to which if we add, the examination of the fragments by the touch; their crackling or grating againſt each other, ſenſible to the ear; the deformity and immobility of the limb, evident to the eye; with a knowledge of the cauſe, its degree of violence, and the manner of its acting, or whether it was aſſiſted by the winter's cold, a decrepid old age, or

or a morbid temperature; from conſidering all theſe at the ſame time, the diagnoſis of the fracture will be ſtill more evident.

This aphoriſm deſcribes thoſe ſigns, by which a preſent fracture may be diſcovered. For there are ſometimes accidents of this nature, in diſcovering which the moſt ſkilful ſurgeon may find much difficulty. Moſt places are furniſhed with a ſet of people who call themſelves bone-ſetters; who though they are for the moſt part very ignorant, endeavour to perſuade the common people, that they underſtand the art of reſtoring fractured or diſlocated limbs, even better than the ſurgeons themſelves. Theſe generally lay the fault of almoſt all diſorders of the limbs either to fractures or luxations, and have immediate recourſe to the application of the whole apparatus uſual in thoſe accidents; by which means they often defraud the patient, and hinder him from his buſineſs without any real neceſſity. By theſe impoſitions they conceal their ignorance, and make thoſe who are unſkilled in theſe matters believe they have performed wonders. But it is the buſineſs of a prudent and honeſt perſon, to uſe his utmoſt endeavours to know whether there is any real fracture or not. The diagnoſis of a fracture is indeed eaſy, when the fragments of the bone are removed from their places, and run up by the ſides of each other, or even force themſelves through the ſkin; but when the fragments remain contiguous, or are ſo little diſplaced, that they ſuſtain each other, and the fractured bone itſelf is covered on all ſides with ſtrong muſcles, as in the thigh; the fracture in that caſe is much more difficult to diſcover. The ſame difficulty is alſo frequently obſerved in diſcovering a fracture in the cubitus or leg, when only one of the two bones, ſeated in thoſe limbs, happens to be broken; as alſo when the ſurgeon is called later than he ought to have been, and

and finds the parts already violently inflamed and ſwelled. A very ſkilful ſurgeon [a] ingenuouſly confeſſes, that he was a long time doubtful in a caſe of this nature, before he diſcovered that there was any real fracture. A certain man, in jumping over a ditch, broke his leg, and the accident happening at a diſtance from any perſon, the patient was obliged to creep a long time on his hands and knees, before he could cry out and make any body hear him: at length ſome countrymen came running to him, and carried him home; where the limb was found ſo greatly ſwelled by the exceſs of pain, that the ſurgeon was obliged to repeat his examination ſeveral times, before he could diſcover that there was a fracture, which happened to be a tranſverſe one of both bones, at about the diſtance of an inch from the ancles. The circumjacent parts here, being very much inflamed, ſwelled, and tenſe, retained the bones in their proper ſituations, whence the difficulty of diſcovering this fracture chiefly reſulted.

That ſpecies of fracture is therefore the moſt difficult of any to diſcover, in which the bones as yet retain their places, ſo as to ſuſtain each other: in which caſe, being ignorant of their poſition, the ſurgeon very often diſplaces the fragments from their contacts, by agitating the limb; from whence follows a greater injury and compreſſion of the circumjacent parts, which renders the cure more difficult; ſince in the firſt caſe there is little or no extenſion of the bones required, to reduce the fragments into their natural places. If therefore any cauſe ſhould injure ſome part of the body, from whoſe forcible and violent action one might reaſonably expect a fracture, the part ought then to be carefully examined before the clothes are taken off, leſt by moving the limb the fractured parts ſhould be diſplaced from their contact with each other, and render the fracture more malignant.

[a] M. de la Motte Traité complet de Chirurgie, Tom. IV. pag. 248.

In

In ſuch a caſe then let the limb be taken hold of on each ſide the part injured, at a ſmall diſtance from thence, and by a prudent agitation endeavour to diſcern whether there is any grating or rubbing of the bones, or ſhaking of the fragments, perceptible to the ear or touch: and if any thing of this nature is perceived, the clothes are then to be rather cut off than pulled off, to avoid diſplacing the fragments from their mutual contacts. There will be yet much more room to ſuſpect a fracture, even from ſlight cauſes, when the bones themſelves have become very brittle through a decrepid old age; ſince at that time of life the medullary oil begins to be exhauſted, and the bones becoming dryer are rendered more brittle. The ſame is alſo true, if the accident ſhould happen in ſeverely cold weather, at which ſeaſon the bones are found by certain experience to be more fragile than at any other time: and we alſo ſee, that not only the bones but almoſt all other bodies become more rigid and brittle in a ſevere froſt.

Beſides this, the bones may be alſo changed by diſeaſes, ſo as to become brittle even to the ſlighteſt cauſe. Thus when the veneral diſeaſe has invaded the bones, it has been frequently obſerved that the bones have broke merely by the weight of the patient's body in getting out of bed. And the like friability of the bones is alſo ſometimes obſerved in the worſt ſpecies of the ſcurvy, rickets, *&c.* There is a ſurpriſing obſervation of this nature related by Hildanus [b], and which was communicated to him by the celebrated phyſician Philibertus Sarazenus. A man of ſixty years of age was troubled with a phlegmatic gout, at the joints of his right ſhoulder and elbow, which tormented him for near the ſpace of two months, with an obtuſe pain: as he was well in other reſpects, he uſed no remedies, but that of retaining the parts affected at reſt. While this man was endeavouring gently to draw on a glove on the hand of the affected

[b] Centur. 2. Obſerv. 66. pag. 139, 140.

arm,

arm, the os humeri broke tranſverſely about four or five fingers breadth below the ſhoulder. Upon removing the dreſſings three days after the bone had been ſet, the phyſician and ſurgeon, who began to be pleaſed with the ſeeming ſucceſs, upon a narrow inſpection found another fracture of the ſame bone, near the elbow, and this they alſo immediately dreſſed with a ſuitable apparatus. But in another epiſtle writ from the ſame phyſician to Hildanus, about ſix months after the accident, there is an account that they had in vain waited two whole months in expectation of a callus to be formed for uniting the bone; and that the man dying afterwards of an inveterate ulcer in his kidneys, they found the os humeri wholly corrupted with a caries. Another caſe of the like nature is alſo related by the ſame author [c]; *viz.* of an honeſt woman near ſixty years old, who had her os humeri fractured in bed, without any external violence, while ſhe was endeavouring to raiſe her body, and put on a clean ſhift. This fracture was afterwards cured by proper aſſiſtance; but when ſhe was about to get up after ſo long a confinement to her bed, the maid aſſiſting to put on her ſtockings, unfortunately broke her right leg tranſverſely. The ſurgeon being called, made a cure likewiſe of this fracture in the uſual manner, without much difficulty. In this manner ſhe ſurvived, ſuffering various fractures, for the ſpace of two years, at the end of which time ſhe expired with excruciating pains. There ſeems to have been nothing of the venereal diſeaſe in this caſe, becauſe the huſband never found himſelf diſordered; and they had ten children in perfect health; nor was there ever any occaſion in the leaſt to ſuſpect the mother's honeſty. Hence it is evident, that a friability of the bones may ſometimes ariſe from latent cauſes, whence they are often fractured by a very ſlight force.

[c] Centur. 2. Obſerv. 68. pag. 141.

SECT.

SECT. CCCXLV.

BUT it is more difficult to diſcover an oblong fracture, till after ſome delay; yet the pain, tumour, thickneſs, and inequality of the part, with the diſcharge of a foul matter, and the known violence of the cauſe, will afford ſome light towards the diſcovery.

A fracture is ſaid to be oblong, when a bone is ſplit according to its length by ſome external violence, like a ſlit in a piece of wood. Such a fracture is very difficultly diſcovered, unleſs it ſhould happen in a part where it lies almoſt naked to the touch, as in the anterior part of the leg, where the os tibiæ lies ſufficiently expoſed throughout its whole length, to be examined by the fingers; but in other parts of the body, a perſon cannot eaſily diſtinguiſh a longitudinal fracture. In reality, the worſt conſequences may follow ſuch a fracture; which conſequences then denote too late that ſuch a fracture is preſent. For in a bone thus ſplit, the veſſels running through its ſubſtance are broke, and their juices extravaſated, whence they putrefy and induce a caries of the bone; or they may alſo inflame and ſuppurate the parts incumbent on the bone. The principal ſigns of ſuch a fracture, if a cauſe ſufficiently violent is known to have preceded, are, the attendance of a deep and laſting pain, with a tumour or elevation of the parts incumbent on the bone, and extending itſelf according to the length of the bone. If after this the integuments break and diſcharge a foul matter, there will be ſtill greater reaſon to ſuſpect that the ſubjacent bone is injured. But even all theſe ſigns are doubtful enough, ſince they frequently follow a violent contuſion, though unaccompanied with any ſuch fracture: it is true, the diſcharge of a foul

manner denotes too late that the bone is corrupted; whence the timely diagnoſis of this kind of fracture is very difficult. But even the diſcovery of ſuch a fracture to be preſent, would not conduce much to the benefit of the patient; for what can art perform, in ſuch a caſe, when all the parts retain their ſituations, and only the bone is injured? Some body will perhaps anſwer, that phlebotomy, with diſcutients, antiphlogiſtic fomentations, a thin diet, *&c.* are to be uſed, to prevent an inflammation, ſuppuration, and all their conſequences. But the contuſion, which always accompanies this ſort of fracture, will require thoſe means, even though the bone be not injured. In the hiſtory of wounds in the head, we directed how a fiſſure of the ſkull ought to be treated; but then can other bones ſplit longitudinally in that manner be ſafely denudated, ſo as to be either ſcraped away by the raſp, or bored through with many ſmall foramina? If the thigh bone is known to be thus fractured, who will dare to cut through the ſtrong muſcles which inveſt it, in order to make a way for his hand to the affected bone? This method of cure can be therefore performed in but a few parts of the body, where the bones are only covered with the common integuments; but then in thoſe places it is alſo much more eaſy to diſcover this injury. In the other parts of the body therefore the knowledge of ſuch a kind of fracture muſt be very difficult to obtain, and of no great uſe if known; ſince no other means can be uſed, beſides the general remedies proper for all contuſions.

SECT. CCCXLVI.

THAT the cure will be either eaſy or difficult, quick or ſlow, compleat or defective, may be predicted from the figure, ſimplicity, or complication and age of the fracture;

fracture; as alſo from the number, figure, and magnitude of the fragments; the particular place of the bone fractured, the adjacent parts injured, with the ſeaſon of the year, and the age and habit of the patient.

This aphoriſm treats concerning the prognoſis of fractures, which indicates the bad conſequences to be feared, or the good events to be hoped for. Therefore all the effects of fractures, enumerated in § 343, are to be here conſidered, and after a ſtrict examination, we may then conclude (from the known nature of the fracture, with an anatomical knowledge of the parts) whether the cure will be eaſy or difficult: but the cure is ſaid to be eaſy, when it can be performed without any great endeavours of art, and without much trouble to the patient; and it is ſaid to be difficult, when the contrary obtains. In the next place, it ought to be determined whether a long or a ſhort ſpace of time will be neceſſary to reſtore the bone to its due firmneſs and continuity. And laſtly, it muſt be enquired whether the cure may be expected to ſucceed ſo well, that the broken limb will recover the ſtrength, form, and action which it had before; or whether any ſenſible defect will remain after the cure, ſo as either to diſfigure the injured limb, or elſe impede or deſtroy its action. But in doing this great prudence is neceſſary; for generally the remaining defects are imputed to the fault of the ſurgeon, to his great prejudice, if he does not foretel them. For though an honeſt ſurgeon ought not, like a pretending quack, to magnify a ſmall injury, that he may be thought to have done great matters; yet prudence requires of him to mention the bad conſequences to be feared, leſt he ſhould be thought ignorant or incapable in his art. If a ſurgeon who is too fearful, makes a bad preſage in a ſlight caſe, frequently another is called to undertake the cure; and

if he ſucceeds, it injures the character of the former. Nor will it be leſs prejudicial to promiſe a happy cure, and the event proves bad. But to form a ſafe prognoſis, attention muſt be given to the following particulars.

Figure of the fracture.] That kind of fracture is of all the beſt, which is termed tranſverſe or raphanoide: eſpecially if the fragments as yet ſuſtain each other, and are not quite diſplaced. But the cure of an oblique fracture is much more difficult; becauſe in that the fragments do not mutually ſuſtain each other, and they are very eaſily diſplaced or removed from their contacts by the contraction of the muſcles faſtened to the bones, nor is it eaſy to ſecure the parts ſo by bandage, that the fragments ſhall continue in their proper places after they have been reduced. Celſus[a], treating on fractures, has very well expreſſed this; for he ſays: *Earum maxime tolerabilis eſt ſimplex, eaque tranſverſa: pejor, ubi obliqua, atque ubi fragmenta: peſſima, ubi eadem acuta ſunt:* "Of "theſe fractures, the moſt tolerable is the ſimple and "tranſverſe; but it is worſe when the fracture is ob-"lique, and when there are fragments; and the worſt "of all, when thoſe fragments are ſharp pointed."

Simplicity or complication.] It is very apparent, that the cure muſt be much more difficult when the bone is fractured in ſeveral places; and the more ſo, if the fractured places are ſo diſtant from each other, that they cannot be inveſted by one and the ſame apparatus, but each fracture muſt have its particular dreſſings. A remarkable caſe of this nature is given us by Le Motte[b], of a man who broke his leg both towards the ancles and the knee: after both fractures had been dreſſed with a convenient apparatus, the uppermoſt continued well enough, but the lower fracture had ſuch ſevere pains, as made it neceſſary to treat it afterwards with the foliated bandage, in the

[a] Lib. VIII. cap. 10. pag. 530.
[b] Traité complet de Chirurgie, Tom. IV. pag. 254, &c.

manner

manner of a compound fracture. But if the fracture is complicated, as well as compound, that is, if it be accompanied with a wound, contuſion, inflammation, &c. you will foreſee the cure to be ſtill more difficult.

Age of the fracture.] When the parts of the fractured bone continue in their natural ſituations, there is no great danger to be feared from the long continuance of the fracture; becauſe art can do nothing more in that caſe, than prevent the fragments being diſplaced, by the application of a ſuitable apparatus. But where the fragments no longer ſuſtain each other, but ride over or ſlip up by the ſides of each other, then the diſtraction and laceration of the parts is the greater, in proportion as a longer time has elapſed ſince the fracture; whence enormous pains, inflammation, tumour, &c. uſually follow; and in that caſe it is impoſſible to reduce the fracture before thoſe ſymptoms are removed, or in ſome degree mitigated. For if a part thus violently inflamed and ſwelled was to be roughly handled, it would ſoon be invaded with a gangrene; or from the great ſeverity of the pain, convulſions might follow. But when the bone is expoſed naked in a compound fracture, or if a fragment of the bone ſtarts through the ſkin, in that caſe the cure may be reaſonably expected to ſucceed more ſlowly and difficultly, as the parts have been longer expoſed to the air; becauſe here it is often neceſſary to wait for an exfoliation of the diſeaſed part of the bone; as is evident from what has been ſaid on this ſubject, in the hiſtory of wounds of the head, § 249, 250.

The number, figure, and magnitude of the fragments.] The more numerous the fragments, the more difficult will it be to retain them in their proper ſituations, after they have been reduced; which will be alſo the more difficult, as the fragments are leſs: as for example, if the os humeri is fractured in two places, ſo that a piece of its middle is ſeparated, to the length of three fingers breadth; ſuch a fracture,

though ever ſo well reduced, would be very difficultly retained in its proper ſituation, ſince the contraction of the muſcles, and the preſſure of the ſplints and bandages, would be very apt to diſplace the fragments. Such a fracture would therefore require a machine capable of retaining the limb in its due extenſion; and as ſuch fractures require the moſt formidable aſſiſtances of art, they cannot be termed eaſy to cure. In ſuch like fractures, Hippocrates [t] recommends the uſe of two cylinders, or round plates of Turkey leather, like what is uſed by thoſe who are a long time confined in heavy fetters; and in a fracture of the leg, he directs to apply one of them above the ancles, and the other below the knee. Theſe plates are to be furniſhed with loops on each ſide, of ſingle or double leather; in ſuch a manner that the loops of the upper plate may correſpond to thoſe of the lower: he then introduced ſplints of horn of a due length into thoſe loops, which held the leathern plates extended to their due diſtances. Thus did Hippocrates maintain the limb at its due length, and preſerve the fragments from being diſplaced at the ſame time; and in the ſame place he deſcribes at large, what more is neceſſary to be obſerved in the application of the plates. But when the fragments are ſharp pointed, the caſe is very difficult to cure; becauſe the fragments greatly injure the adjacent parts, and are difficultly retained as well as reduced, as we ſaid before in the comment on § 342. It alſo appears from chirurgical obſervations, that the diviſion of a bone made by a ſharp or cutting inſtrument, cannot be cured in ſo ſhort a ſpace of time, as a fracture by a blow with an obtuſe inſtrument; which ſeems indeed wonderful. But the reaſon may perhaps be this, that a common fracture has always ſome eminencies or aſperities, which retain the bones more firmly together, after they have been rightly reduced, ſo that they can the better unite, and the fragments

[t] De Fracturis Textu, 29. Charter. Tom. XII. pag. 246.

are

are not ſo liable to be moved or rubbed againſt each other in coughing, ſneezing, or the like motions; which attrition muſt deſtroy the repullulating callus, or at leaſt retard the union of the fractured bone. But when a bone has been divided by a cutting inſtrument, the ſurface of the fragments is ſmoother, and they are more liable to be moved or rubbed againſt each other. There are three or four remarkable caſes, in confirmation of this, to be found in the obſervations of the deſerving Le Motte [a], who affirms, that an inciſed fracture, even a ſimple one, takes double the time in the cure, which a common or even a bad complicated fracture requires, except thoſe which have a conſiderable loſs of ſubſtance, or a violent contuſion of the bone into ſmall ſplinters.

The part of the bone injured.] It was ſaid in the commentary on § 342, that fractures have various conſequences, according to the different part of the bone that is injured. Celſus enumerating ſome of the effects common to fractures of the arms, thighs, legs, and fingers, ſays, *Siquidem ea minime periculoſe media franguntur: at, quo proprior fractura capiti vel ſuperiori, vel inferiori eſt, eo pejor eſt. Nam et majores dolores adfert, et difficilius curatur:* "That they "are indeed broke with the leaſt danger in the mid-"dle; but the nearer the fracture is to the upper or "lower head of the bone, it is ſo much the worſe; "for it then occaſions greater pains, and is more dif-"ficultly cured." For the larger bones are the hardeſt in their middle; but in their extremities, which are articulated to the next adjacent bones, they are cellular and friable. The difficulty is alſo ſtill augmented by the adjacent ligaments of the articulations which connect the bones. There is alſo much difference betwixt a fracture in the upper or in the lower end of the bone, as we demonſtrated from the teſtimony of Hippocrates in the commentary on § 342.

[a] Traité complet de Chirurgie, Tom. IV. pag. 303—318.
[b] Lib. VIII. cap. 10. pag. 530.

Thus Hildanus[f] has obſerved, that if the os femoris is fractured near its articulation with the hip, the fracture can hardly ever be cured without a halting of the limb remaining; but that when the ſame bone is fractured in the middle or towards the knee, it may be often cured by an expert ſurgeon without any defect remaining. And in the ſame place he confirms his aſſertion by the teſtimony of many conſiderable authors.

The adjacent parts injured.] Concerning theſe, ſee what has been ſaid in the commentaries on § 342.

Time or ſeaſon of the year.] Hippocrates[g] has pronounced warmth to be very friendly to fractured bones, eſpecially if they are naked; but cold, he ſays, is an enemy to the bones[h]: and therefore the cure of a fracture will (*cæteris paribus*) ſucceed leſs proſperouſly in winter than in ſummer. But in the ſummer heats there is greater danger of a putrefaction; and therefore a cure may be expected to ſucceed the moſt happily in ſpring and autumn.

Age of the patient.] The nearer a perſon is to the birth, the more ſpeedily does a fractured bone unite; and in extreme old age a fracture either not at all unites, or at beſt but very ſlowly: but in younger ſubjects there is more danger of a luxuriancy of the callus; which makes a middle age ſeem to be the beſt. The eminent ſurgeon Le Motte[i] ingenuouſly confeſſes, that he had twice met with the misfortune of breaking an arm in extracting the fœtus by its legs in difficult births; but then they were eaſily cured by a ſlight apparatus in twelve days time, whereas in adults, who are in health, a fracture requires at leaſt thrice that time to be conſolidated.

Habit or temperature.] All thoſe diſorders, which either conſume or corrupt the fat of the body, occa-

[f] Centur. V. Obſerv. Chirurg. Obſerv. 86. pag. 475, 476.
[g] Aphor. 22. Sect. V. Charter. Tom. IX. pag. 207.
[h] Ibid. Aphor. 18. pag. 204.
[i] Traité complet de Chirurgie, Tom. IV. pag. 171.

ſion

ſion fractured bones either not to unite at all, or at leaſt but very ſlowly; and therefore fractures are hardly curable in the worſt ſtages of the venereal and ſcorbutic diſeaſes, and in the rickets, conſumptions, *etc.* as appears from the inſtances which we mentioned in the commentary on § 344. But there is perhaps ſuch a latent diſpoſition in the habits of ſome people, which prevents the bones from eaſily uniting, even though no remarkable cacochymy or other viſible diſorder attends. The celebrated Ruyſch [k] aſſerts, he has met with ſuch a caſe, where the bones would not unite, even though all the proper rules of art were obſerved towards obtaining a cure. And in his obſervations anatomical and chirurgical [l] he relates, that in the body of a man, who was hanged in full health, he found two of the anterior bones of the carpus not yet conjoined, even though they were fractured three years before. I have myſelf ſeen a woman, who having broke her arm, it was afterwards reduced according to art, but it never united, even though ſhe was in the flower of her age; whence her arm remained flexible in the part where it had been broken during her whole life-time afterwards, which was yet no great inconvenience to her. It is an obſervation made by Hildanus [m], that the conſolidation of fractured bones ſucceeds very difficultly in women with child; and he relates the caſe of a fracture in the middle of the tibia in a woman, who had paſſed the ſeventh month of her pregnancy, but the fragments were not united, though three and twenty weeks were elapſed ſince the fracture; but at length in the thirtieth week the cure was compleated. But in this woman the fracture was attended with a conſiderable wound, and ſome fragments of the bone came away; whence it may be perhaps judged, that theſe accidents rendered the cure ſo ſlow and difficult. But he has in another place [n] gi-

[k] Adverſ. Anatom. Decad. 2. n° 2. pag. 6.
[l] Obſervat. IV. pag. 8. [m] Centur. V. Obſerv. 87. pag. 484.
[n] Centur. VI. Obſerv. 68. pag. 582.

ven

ven a very remarkable hiſtory, which confirms the difficulty of curing fractures in women with child. A woman of quality, of a corpulent and plethoric habit, endeavouring to mount a horſe, broke her left tibia betwixt the knee and the ancle: the fracture was happily reduced the ſame day by Hildanus, who neglected nothing that might forward a ſucceſsful cure; and as no pain, nor any other bad ſymptom appeared, he hoped that the cure might have been compleated within the ſpace of two months. When the fortieth day came, the callus was found ſoft and ſlippery; but as the patient had hitherto ſuckled an infant, ſhe was ordered to wean it; in a little time after ſhe appeared to be with child, and was happily delivered of an healthy and ſtrong girl ſeven months after the fracture was received. The fractured bones could not be united, during the whole time of pregnancy, by all the means that were tried; even though the lady's impatience and continual complaints of the ſlowneſs of the cure excited Hildanus to uſe the utmoſt diligence and induſtry. Yet within thirty days after her delivery the callus became firm, and the limb recovered its former uſe and ſoundneſs. Hence he concludes, that nature being fully employed in forming and perfecting the fœtus, in a manner neglected to form a callus. Obſervations of the like nature, in confirmation of this, may be ſeen in the *miſcellanea curioſa* *. But we are in the ſame place furniſhed with the hiſtory of a woman, who having broke her left knee-pan in the fifth month of her pregnancy, was nevertheleſs ſo well cured in the ſpace of ſix weeks, that ſhe could walk about the houſe with ſome difficulty. Hence, therefore, though it does not ſeem to be an univerſal concluſion that fractures of the bones in women with child will not unite before the birth; yet it ſeems adviſeable in theſe caſes to mention the difficulty beforehand, leſt the ſlowneſs of the cure ſhould be af-

* Decur. 1. A. 1. Obſerv. 25. pag. 91.

terwards

terwards imputed to ſome fault in the ſurgeon or phyſician.

SECT. CCCXLVII.

THE cure of a fracture requires, 1. A reſtitution of the parts into their natural ſituations by extenſion and reduction. 2. A retention of them in that poſition by bandages and machines or inſtruments. 3. A conſolidation of the united and retained fragments by the growing up of a callus.

We have here the general method of cure common to all fractures. But every cure is the producing of ſuch a change in the parts of the living body, as will remove the corporeal effect, termed the diſeaſe, (ſee the comment on § 4.) and likewiſe reſtore that, whoſe abſence produced the diſeaſe. Now in a fracture there is always a removal of the continuity of the bone, and generally a change in the natural ſituation of its parts; whence it evidently follows, that the cure will require firſt a reſtitution of the divided parts to their natural ſituations, and then a conſolidation or union of them; both which may be obtained by the means deſcribed in the three numbers of this aphoriſm.

1. When the ſituation of the parts has been altered, an extenſion is always required before the fragments of the bones can be ſafely reduced. For the ſurfaces of the fragments are generally rough and unequal; whence, if the reduction was to be attempted without an extenſion, the fragments would grate againſt each other, and break off ſome ſplinters or aſperities, which interpoſing betwixt the fragments, would either retard their conſolidation, or being thruſt out into the adjacent ſoft parts, they would irritate and injure the membranes, tendons, *etc.* as Fabricius Aqua-

Aqua pendente has very well obſerved [a]. Add to this, that the muſcles contract themſelves (as we mentioned in the comment on § 343.) ſo ſoon as the coheſion of the bone is removed, which directs and ſuſtains them; whence an extenſion of them appears to be neceſſary before the fragments can be replaced.

2. After the bones have been reduced to their natural ſituations, that alone would ſuffice, if the part could be retained without motion by the influence of the will; but as there are frequently very conſiderable commotions produced in the body, either without the patient's knowledge; as in ſleep; or without his inclination, as in ſneezing, coughing, laughing, *etc.* by which means the replaced bones might eaſily be diſturbed from their ſituations; for this reaſon therefore, bandages, compreſſes, ſplints, and other machines are required, according to the nature of the part injured, to retain the limb firm and immoveable. It is frequent with many patients, for the firſt two or three nights after the fracture is reduced, to pull up the affected limb ſuddenly in their ſleep, in a manner as if it was convulſed; whence they uſually awake in a fright: now if in ſuch a caſe the limb was not properly ſecured, the reduced fragments would be removed, and require to be replaced again. This is what Parey [b] laments to have happened to himſelf, that while he was ſleeping in the night-time, his broken leg ſo forcibly ſtarted up of a ſudden, that the fragments were diſplaced; whence a new extenſion and reduction was neceſſary; and which were performed with much greater pain than at the firſt time.

3. It was demonſtrated in the commentaries on § 343. that the fragments united and grew to each other, not by the interpoſition of a glue, which by its coheſion faſtened the ends of the bone together, but by a true union of their ſubſtance, in the ſame manner as in wounds of the ſoft parts, there is a union

[a] Oper. Chirug. Lib. IV. de fracturis, cap. 3. pag. 328.
[b] Livre XV. Chapit. 25. pag. 346.

of

of the divided parts and a reproduction of the loſt ſubſtance. From whence it is very apparent, that art can do nothing in this reſpect, but that the nature and fabrick of the human body only performs the whole, while healthy juices are diſtributed in a due quantity, and with a proper force through their reſpective veſſels to the parts injured. All therefore, which has been ſaid concerning the regimen and diet proper for the cure of wounds in general, is here applicable. And hence it is, that fractured bones are obſerved to unite ſo ſoon in infants; and ſo very ſlowly or not at all in thoſe of a decrepid old age: becauſe the younger the patient, or the nearer to its birth, the faſter it is obſerved to grow or increaſe. Hence Hippocrates [c] juſtly pronounces, *Aluntur quædam ad incrementum, et ad eſſentiam; quædam ad eſſentiam ſolam, ut ſenes: quædam præterea et ad robus:* "Some are nouriſhed "ſo as to increaſe their body, as well as preſerve it; "and others only ſo as to preſerve it, as in old peo- "ple: ſome again are ſo nouriſhed as to acquire "ſtrength alſo." From hence it is ſufficiently evident, that viſcid aliments conduce nothing to the formation of a callus, ſuch as the decoctions of the ſeveral ſorts of corn, and the jellies of animal ſubſtances, which are recommended by *Fabricius ab Aquapendente* [d]: but that theſe will be rather prejudicial, as they are ſo difficult to digeſt, eſpecially in quieſcent bodies, where they occaſion a ſpontaneous glutinoſity, firſt in the *primæ viæ*, and then in the blood, as we demonſtrated in the commentary on § 69. Hildanus [e] tells us he obſerved a man of forty years old of a good habit to fall into a cachexy by ſuch a viſcid diet, which was preſcribed to him by an empiric; whence he was afterwards troubled with a jaundice, accompanied with other bad ſymptoms, and at length he periſhed of a dropſy. Nor can we expect the uſe

[c] De Alimento Text. 45. Charter. Tom. VI. pag. 293.
[d] Opera Chirurg. Lib. IV. de fracturis, cap. 6. pag. 335.
[e] Centur. 1. Obſerv. Chirurg. Obſerv. 92. pag. 71.

of

of the ſo much praiſed lapis oſteocolla to conduce any thing more to the formation of a callus, becauſe its hollowneſs and ſimilitude (having a cavity like that in which the medulla is depoſited in the middle of the bones) has made ſome people imagine it a ſpecific medicine for the bones; which it alſo reſembles in its ſpongy texture and friability. It is indeed evident, that this earthy and unactive medicine may be ſafely adminiſtered; but that it has any ſuch efficacy towards the production of a callus, hath not yet appeared. Hildanus [f] indeed extols the virtues of it, and aſcribes to it his happy ſucceſs in the cure of a fracture of both bones of the leg in a man of forty years old of a bad habit; and he alſo aſcribes the too great luxuriancy of a callus to the imprudent uſe of this ſtone in a healthy lad of fourteen years old of a ſanguine habit. But we very well know, that even very bad fractures are happily cured in adults without the uſe of this ſtone; and we alſo know that the callus abounds in younger patients. But though Hildanus aſcribes his happy ſucceſs as above ſolely to the uſe of this ſtone, yet we find that he had recourſe to other more efficacious helps, when he found nature languiſhing in the body of an old patient [g]. Namely a decrepid old man of ſeventy received a compleat fracture of the bones about the carpus by a blow with a ſtick; and many years before he had been troubled with a palſy of the ſame ſide, which was not yet entirely removed. After replacing the fragments, Hildanus being obliged to undertake a long journey, left the reſt of the treatment to his ſervants; but returning again after a month, upon examining the part fractured, he found by the grating of the bones that they were not yet united by a callus. After ordering a very rich and nouriſhing, but not a viſcid, diet, he gave the lapis oſteocolla night and morning with cinnamon; he afterwards daily anointed the arm with a

[f] Obſerv. Chirurg. Centur. 1. Obſerv. 90 & 91.
[g] Ibidem, Centur. 3. Obſerv. 90. pag. 275.

ſtimulating

ſtimulating aromatic unguent, and then applied an emplaiſter of the ſame kind, with which ſome lapis oſteocolla was intermixed; and by theſe means in a few days time there was no grating of the bones to be heard, but the cure was compleated in the ſpace of four weeks. Hildanus would willingly aſcribe the ſucceſs of the cure to the lapis oſteocolla: but in reality the rich diet excited the languiſhing powers, the ſtimulating ointment and aromatic plaiſter procured the juices to flow more effectually and powerfully into the affected parts, and by theſe means conſpiring the cure was compleated. How much may be done towards reſtoring a defective nutrition in any part of the body, by ſuch a ſlight or gentle irritation, has been already obſerved in the commentary on § 35. numb. 3. But when by weakneſs, or from the ill condition of the fracture, thoſe powers are abſent, which unite the divided parts, and regenerate the loſt ſubſtance of the human body, in vain is the lapis oſteocolla adminiſtered, as is evident even from the teſtimony of Hildanus [s] himſelf. For he candidly confeſſes, that he adminiſtered this ſtone, and applied it externally without ſucceſs in a woman with child; and that after her delivery the cure happily ſucceeded. From hence I believe it is ſufficiently apparent, that ſuch remedies may be uſed without harm; but that the regeneration of the loſt ſubſtance, and the reunion of the divided parts, as well in the bones as in the ſoft parts, is to be expected from the nature of the human body only, which is of itſelf ſufficient.

SECT. CCCXLVIII.

IF the fragments retain their proper ſituations, the firſt indication then ceaſes.

If they have receded but a little to either ſide, only a ſmall extenſion is then required.

[s] Obſerv. Chirur. Centur. 5. Obſervat. 87. pag. 484.

But

But if the fragments are ſo diſplaced that they run up by the ſides of each other, a large extenſion is then required in order to remove the intercepted parts, make a ſuitable reduction, and reſtore the whole to its due length.

Retain their ſituations, *etc.*] It ſometimes happens, eſpecially in the winter-time, when all bodies are more rigid and brittle, that a bone is ſo fractured by a fall or other accident, that the fragments remain in their natural ſituations; and ſuch a fracture is known chiefly from the preceding cauſe being ſufficiently violent, the pain deep, and a grating or crackling of the bones ſenſible to the ear or hand, when each part of the limb is agitated by the two hands. If then no alteration can be obſerved in the figure of the part, upon comparing it with the like part that is ſound, (though the ſituation of the parts may be changed by turning them round, while the fragments remain contiguous) it is very evident that no extenſion nor reduction is then required, only the fragments are to be retained in that ſituation in order to a cure.

If they recede but a little, *etc.*] A bone is often broke ſo, that the fragments ſupport each other, and yet form a protuberance on each ſide; or though the fragments remain in contact with each other on all ſides, yet the bones may be ſo twiſted, or drawn ſideways, as to change the ſituation and direction of the parts inſerted into the bones, which will appear from the deformity or injured figure of the limb. No violent extenſion is required in theſe caſes, only ſuch will be ſufficient, as is capable of ſetting the bones at liberty from touching each other, that they may be reduced to their proper places without any grating of the fragments or ends of the bones.

By the ſides of each other, *etc.*] For then the limb is contracted in its length in proportion as the fragments ride more or leſs over each other; and therefore

therefore ſuch an extenſion is here required before the reduction can be made, as will draw the parts a little beyond their natural length, that the fragments may be replaced without rubbing againſt each other, and without intercepting any of the adjacent parts. Whence Celſus [a] obſerves, after deſcribing the ſigns by which ſuch a fracture may be known; *Ergo, ſi hoc deprenſum eſt, protinus id membrum oportet extendere. Nam nervi muſculique, intenti per oſſa, contrahuntur: neque in ſuum locum veniunt, niſi illos per vim aliquis intendit*; "Therefore when this ſort of fracture "is diſcovered, the limb muſt be immediately extend-"ed: for the nerves and muſcles, which are kept "extended by the bones, are then contracted; nor "will they recover their ſituation, unleſs they are ex-"tended by ſome force." And afterwards he adds, *Ubi vero paulo longius, quam naturaliter eſſe ſolet, membrum vis fecit, tunc demum oſſa manibus in ſuam ſedem compellenda ſunt, &c.* "But when the extending force "has made the limb a little longer than it naturally "uſed to be, then it is that the bones muſt be preſ-"ſed into their proper places by the hands, &c." Nor is it eaſy to make too great an extenſion, eſpecially in fractures of the larger bones; and therefore Hippocrates [b], in treating of a fracture of the thigh bone, orders a ſtrong extenſion to be made; and adds, that the limb will not be injured, though the extenſion be made larger than neceſſary. And in another place he obſerves [c], that moſt make their extenſion leſs than they ought; but that he had ſeen too violent an extenſion made on a child. For in the younger age all the parts are ſofter, and a violent extenſion may there force the parts a good deal beyond their natural length, which is not much to be feared in adults, eſpecially in fractures of the larger bones; for the ſtrong muſcles and tendons in them ſufficiently guard

[a] A. Corn. Celſi Medicin. Lib. VIII. cap. 10. pag. 532.
[b] De fracturis, Textu 68. Charter. Tom. XII. pag. 222.
[c] Textu 19. ibid. pag. 167.

againſt too great a diſtraction of the parts. Add to this, that a ſkilful ſurgeon may diſcover when the extenſion is made ſufficiently, or whether it is required to be ſtronger, by feeling the fractured parts with his hands. In fractures of this kind therefore all ſurgeons order a forcible extenſion; and Parey [d] ſtrongly invited the ſurgeon not to ſpare him when his broken leg was to be ſet; deſiring of him at that time to forget that he was curing a friend. But how violent an extenſion is ſometimes required in difficult caſes, may appear from the following hiſtory. A young man broke the tibia and fibula of his right leg near the ankle in ſuch a manner, that the bones forced their extremities for near two inches through the integuments: and in this condition the unfortunate patient lay for ſeven hours before the ſurgeons could attend, whence the limb was by that time very much ſhortened, and a conſiderable tumour formed in the circumjacent parts. This fracture was alſo attended with a conſiderable wound, and the celebrated ſurgeon chiefly concerned owns, that the extenſion was made ſo forcibly in order to replace the fragments, that his aſſiſting ſurgeon often cautioned him not to let the foot be pulled off [e]. But in what manner the extenſion of a broken limb may be conveniently made, and with what precautions, is taught in the following aphoriſm.

SECT. CCCXLIX.

THE extenſion is performed, 1. by taking firm hold of the bone near the fracture, either with the hands or with ſlings; 2. by firmly ſecuring the patient; 3. by placing the part in its natural poſture; 4. by a ſlow diſtraction

[d] Livre XV. Chapit. 23. pag. 344.
[e] De la Motte Traité complet de Chirurgie, Tom. IV. pag. 293. &c.

of

of the fractured parts from each other, in a right line, with ſuch a force as is ſufficient to overcome the contractile power of the muſcles; 5. or laſtly, by the power and application of mechanical inſtruments, if the ſtrength of the hands fail.

1. If nothing forbids, the injured limb is to be taken hold of by the hands near the place of the fracture; but ſometimes a wound, violent contuſion, or a diſtortion of the muſcles, ſurpriſingly altering the figure of the part, forbid the application of any force to the circumjacent parts of the fracture. But ſince the ſurgeon, who reduces the fragments, cannot at the ſame time make the extenſion of the limb himſelf, except in the leſſer bones, as of the fingers, *&c.* it is therefore neceſſary to have aſſiſtants, who may make the extenſion at the ſame time that he replaces the fragments into their proper ſituations. Therefore the moſt ſkilful ſurgeons, eſpecially in the more dangerous caſes, call in the aſſiſtance of other ſurgeons, who, underſtanding the method of extenſion, know how to perform it as equally as poſſible, which conduces a great deal towards a happy reſtitution of the fragments. But as the part is often required to be kept a conſiderable time extended, before the fractured bones can be duly replaced, therefore thoſe who make the extenſion ought to be placed ſo, that they may continue in the ſame poſture for a conſiderable time without uneaſineſs, or elſe the operation might be interrupted. The beſt method of extenſion is by the hands, becauſe that way the direction is ſooner changed and more eaſily perceived, when it deviates from a right line; but if the thickneſs of the limb is ſuch as prevents the hands taking firm hold of it on each ſide, as in a fracture of the thigh-bone; then it is adviſeable to extend the part by ſlings faſtened on each ſide. Hence Celſus[a] obſerves, *Intendunt autem digi-*

[a] Lib. VIII. cap. 10. pag. 532.

tum vel aliud quodque membrum, ſi adhuc tenerum eſt, etiam unus homo poteſt, cum alteram partem dextra, alteram ſiniſtra prehendit. Valentius membrum duobus eget, qui in diverſa contendant. Si firmiores nervi ſunt ut in viris robuſtis, maximeque in eorum femoribus et cruribus evenit, habenis quoque vel lineis faſciis utrinque capita articulorum deliganda, et per plures et in diverſa ducenda ſunt; "But to extend a finger, or any other "limb that is ſlender, one man may be ſufficient, "if he takes hold of one ſide with his right hand, "and of the other with his left. A ſtronger limb "requires two people, who may pull in oppoſite di- "rections. If the tendons or ligaments are very "ſtrong, as in robuſt men, and eſpecially if the frac- "ture happens in their thighs or legs, then ſlings or "linen bandages are to be tied round the two heads "of the bone at its articulations, and to be pulled "by ſeveral people in oppoſite directions."

2. The reduction of a fractured bone ought never to be attempted, unleſs the patient is retained immoveable either by ligatures or proper aſſiſtants. We ought not in this caſe to truſt to the ſtrength and courage of the patient, ſince the pain is frequently ſo ſevere while the fractured limb is extended, that it may oblige even the ſtrongeſt man to reſiſt and diſturb the operation againſt his will.

3. That is ſaid to be the natural poſture of the part, which it acquires when a man is at reſt, or rather in a ſleep; for then all voluntary motions ceaſe, and the parts of their own accord fall into their natural and moſt eaſy poſture. The joints are never then extended, nor yet inflected but in a ſmall degree. Now while the parts are in this natural poſture, all the muſcles are then the leaſt extended; but if the part is altered from that poſture, even againſt the inclination of the will, then thoſe muſcles will ſwell, which were deſtined to change the poſture of the limb in the ſame manner by the will. Thus, for example, the ſtrong deltoide muſcle elevates the arm; but

but if the arm be lifted up by any other perſon, the ſame muſcle will appear manifeſtly to ſwell, though not to ſo great a degree, as if the arm was raiſed by the influence of the will. But when a broken limb is extended in order to replace the bones, the muſcles muſt be elongated, which may be done with a much leſs force when they are flaccid, than when they are ſwelled or turgid. Beſides, if the limb is extended while it does not retain the natural poſture, it will require to be reſtored to its natural poſture after the bones have been replaced, becauſe it cannot continue long in any other poſition without pain; but in doing this the ſituation of the parts will be altered, and the fragments will often be forced again out of their places. This is intended by Hippocrates [b], when he ſays, *Ex quieſcente vero ac remiſſa rectitudines* (ἰθυωρίαι) *ſpectandæ ſunt velut in manu*; "You are to obſerve that the limbs "remain not ſtraight but a little inflected, like the "hand when it is not in action." And Galen in his commentary to this text ſays, *Quibus in figuris, quum otiamur, partes habere conſuevimus, hæ in curationibus eligendæ ſunt*; "That we are to chuſe that poſture "of the parts in the cure, in which we uſually place "the limbs when we are at reſt." And a little after deſcribing the natural poſture of the hands for example, he adds, *Itaque, ſi homines otiari conſideraveris, plerumque manus inter ſummam extenſionem & extremam flexionem non plane medias reperies, ſed quæ ad extenſionem propendeant:* "If therefore we conſider the poſture of "the parts in men at reſt, you will not find that the "hands or arms retain a juſt medium betwixt flexion "and extenſion, but that they incline a little from "extenſion." But Hippocrates himſelf ſays in the beginning of his book on fractures [c], having firſt obſerved, that the extenſion both in fractures and luxations ought to be made as nearly as poſſible in a right line:) *plerumque nihil peccare illos, qui nihil prævio*

[b] De Medici officina, Textu 21. Charter. Tom. XII. pag. 87, 88.
[c] Charter. Tom. XII. pag. 153, &c.

conſilio faciunt, ipſe enim deligandus manum porrigit, ita coactus à juſta natura, ſolos autem illos peccare, qui ſibi plus ſapere videntur; "Thoſe generally run into "error, who do nothing with previous advice, for "ſuch a perſon extends the hand to be bound up, "being ſo directed by unerring nature; but thoſe "only offend, who think themſelves wiſer than na- "ture." He afterwards in a very ample manner, diſapproves of their opinion, who bind up the hand and fore-arm in a prone poſture; and he blames them ſtill more, who prefer a deligation of thoſe parts in a ſupine poſture, which is much more inconvenient than the former. He then well obſerves, that while ſome bind up thoſe parts extended, they often excite pains and other accidents worſe than the injury itſelf; and when they order the patient to bend the joints afterwards, neither the bones, tendons, nor muſcles are any longer retained in their proper ſituations, but the reſiſtance of the bandage being overcome, they are removed out of their places. And in another place [d], treating of a fracture in the arm, he ſays, *Si autem quis brachium extendens in illa poſitura deliget, brachii muſculus tenſus alligabitur, poſtea autem, ubi ſic deligatus cubitum flexerit, muſculus brachii aliam poſituram habebit*; "But if any one extends "the arm, and binds it up in the ſame poſture, the "muſcles of the arm will be bound together in a "ſtate of tenſion; but when the patient, who has "been thus treated, endeavours afterwards to bend "his elbow, the muſcles of the arm will acquire a "poſture different from their natural one." It is therefore evident, how important this rule is in the cure of fractures. Thus, for example, the natural poſture of the os humeri is parallel to the trunk of the body, when none of its muſcles are in action; and therefore in a fracture of that bone, the limb ought to be retained in that poſture during the extenſion. If the bones of the cubitus ſhould be fractured,

[d] Charter. Tom. XII. pag. 88.

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the limb ſhould be a little inflected at the elbow, and the hand retained in a poſition betwixt prone and ſupination. The like is alſo true of the other limbs.

4. Haſtineſs is always prejudicial here; ſince it is required to reſtore the diſplaced fragments of the bone to their proper ſituations, without offering further injury to the adjacent ſoft parts within their contacts. But unleſs the extenſion be made in a right line, the fragment will offer a greater injury to the adjacent parts. But this extenſion ought to be made ſlowly or gradually, becauſe the contracted muſcles, which are often contorted or diſplaced at the ſame time, cannot be violently elongated all on a ſudden without danger of throwing them into convulſions. Therefore the extenſion of the fractured limb ought to be very gradually and equably increaſed; by which means the contracted parts may be the moſt ſafely elongated. Hence Hippocrates [c] directs, in ſetting a fracture of the humerus, to ſuſpend almoſt the whole weight of the patient, by placing a board or ſome other ſupport under the arm-pit; or at leaſt to fix it ſo that it will not give way, and then the cubitus being bent ſo as to form a right angle with the os humeri, is to have a ſoft ſtrap faſtened round it, to which a heavy weight muſt be appended, in order to make a moderate extenſion of the limb: he afterwards adds, that a ſtrong man may ſupply the place of the weight, by pulling the affected parts downwards. But it is very evident that a man, in pulling or extending the limb, ought as much as poſſible to imitate the equable force of the weight, which, being appended, elongates the parts. But the bounds of the extenſion is limited to the elongation of the limb a little beyond its natural length, as we obſerved before from Celſus, under the preceding aphoriſm; for then the fragments may be replaced without any grating againſt each other, and without intercepting any of the ſoft parts adjacent. Nor is it eaſy to offend by making the extenſion too

[c] De Fractur. Textu 3. Charter. Tom. XII. pag. 189.

great, eſpecially in fractures of the larger bones, as in the femur, for example, which Hippocrates has well obſerved. But a greater or leſs extenſion will be required, according as the muſcles inſerted into the fractured bones are ſtronger, by the contraction of which the limb is ſhortened. Whence Celſus [r] ſays of theſe fractures in the thigh bones; *Neque tamen ignorari oportet, ſi femur fractum eſt, fieri brevius, quia nunquam in antiquum ſtatum revertitur: ſummiſque digitis poſtea cruris ejus inſiſti: ex quo multa debilitas eſt; fædior tamen, ubi fortunæ negligentia quoque acceſſit.* "Nor ought the ſurgeon to be ignorant, that if the "thigh is fractured, it will be ſhorter, becauſe it can "never be reſtored to its firſt ſtate; and the leg of "that thigh will afterwards tread upon the ends of "the toes, which muſt be attended with much weak-"neſs; but with more deformity, when negligence "alſo heightens the misfortune." Yet it is poſſible that a too violent extenſion may injure the action of the limb by overſtraining the muſcles, which may cauſe a weakneſs in them, as we proved in the comment on § 25. numb. 3. But when a ſkilful ſurgeon places his fingers upon the fractured parts, while the extenſion is making, he can eaſily perceive when it is carried to a ſufficient degree, or whether it is required to be yet ſtronger.

5. The ſtrength of the hands is often inſufficient to make an extenſion of the femur, when fractured in adult and ſtrong men; whence machines have in all ages been uſed for this purpoſe. Hippocrates [s] himſelf deſcribes ſeveral machines for reducing the bones of the legs and thighs, when the hands are not ſufficient; and yet he obſerves, that it is a piece of vain oſtentation to uſe machines when the buſineſs can be done without. Several ſuch machines are figured in the works of Parey, Fabricius ab Aquapendente, and in the Memoirs of the Royal Academy of Sciences, in

[r] Corn. Celſi Medic. lib. VIII. cap. 10. pag. 537.
[s] De Fractur. Charter. Tom. XII. pag. 209, 213.

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almoſt all which machines the parts held firm are elongated at diſcretion by turning round ſcrews. In uſing theſe it is neceſſary to make the extenſion not by ſtarts but equably, and in ſuch a direction that they may act in a right line.

SECT. CCCL.

ALL which (348, 349.) being often impracticable without pain and violence, when the parts are already inflamed, ought therefore frequently to be omitted until the inflammation is abated: otherwiſe the patient may die convulſed, or invaded with a gangrene.

If the bones have been a long time fractured, a large tumour is uſually formed, which is often attended with acute pain and violent inflammation; but every extenſion of a broken limb, whether by the hands or machines, requires a pretty ſtrong force, and a rough handling of the affected parts. It would be therefore a piece of cruelty thus to harraſs the parts already much inflamed and in pain; ſince the ſeverity of the pain will endanger violent convulſions, or we may have reaſon to expect a gangrene from the rough handling of the inflamed parts. Hence Celſus[a] prudently adviſes, after having ſaid that the fractured limb ought to be extended: *Rurſus, ſi primis diebus id omiſſum eſt, inflammatio oritur, ſub qua et difficile et periculoſe vis nervis adhibetur, nam diſtentionem nervorum vel cancer ſequitur, vel certe, cum mitiſſime agitur, pus. Itaque, ſi ante oſſa repoſita non ſunt, poſt eam reponenda ſunt.* "Again, if the extenſion has been neglected for the firſt two or three "days, an inflammation ariſes, by reaſon of which it "will be both difficult and dangerous to apply any "diſtending force to the tendons and ligaments; for

[a] Lib. VIII. cap. 10. pag. 532.

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" convulſions or a gangrene follow, or at leaſt a ſup-
" puration, when the whole is done as gently as poſ-
" ſible: if therefore the bones are not replaced before
" the inflammation is formed, they ought to be re-
" placed after the inflammation is gone off." And Hippocrates [b] ſpeaking on the reduction of fractured bones which perforate the ſkin, likewiſe cautions that the parts ought not to be moleſted when there is an inflammation; and therefore, ſays he, the extenſion or reduction may be attempted on the ſame or on the next day: but by no means on the third, fourth, or fifth day; for then there is more danger of convulſions from replacing the bones than from leaving them untouched. He likewiſe adds, that there are but ſmall hopes of ſucceſs, if convulſions follow the reduction of the bones; and ſays it would then be better to diſplace the bones again, if it can be done without much difficulty. And then he directs to wait till ſeven or more days are expired, after which the reduction may be attempted, if the fever and inflammation are gone off. In another place of the ſame book [c], in treating of thoſe fractures, in which the bone of the femur, or humerus is ſhattered, he obſerves that then the nerves, blood-veſſels, and muſcles are lacerated; and that if the fragments are replaced, convulſions uſually follow; whereas thoſe more frequently eſcape, in which no reduction of thoſe bones has been attempted.

When therefore the violent laceration of the adjacent parts, or the too great length of time which has paſſed before proper aſſiſtance could be had, has occaſioned the parts to be invaded with great tumour, pain, and violent inflammation; we are then certain that a rough handling will be in danger of cauſing convulſions, or a gangrene. It is therefore neceſſary to remove thoſe ſymptoms before a reduction of the bones can be ſafely attempted; or at leaſt it is requir-

[b] De Fracturis. Charter. Tom. XII. pag. 252, 253.
[c] Ibid. pag. 257.

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ed to abate them as much as poſſible. Here then, plentiful bleeding, the application of emollient cataplaſms and fomentations to the injured parts, with internal antiphlogiſtic remedies, and a plentiful uſe of diacodium, are the moſt common and effectual remedies to diminiſh the pain and inflammation, and to cauſe the tumour of the parts to ſubſide. Theſe means are to be repeated according to particular circumſtances, till their effects anſwer the intention of the phyſician; and then, but not before, a reſtitution of the fragments may be attempted. But if notwithſtanding the uſe of theſe means the ſymptoms remain equally violent, or are increaſed, prudence then requires to proceed no further, and if a mortification is feared, the amputation of the limb then only remains; otherwiſe the fractured bones are to be let alone, and the whole buſineſs committed to nature. Hence it is that Hippocrates (as we obſerved in the comment to § 343.) adviſes phyſicians not to meddle with theſe caſes, when they can avoid them without reflections: for if the fractured bones are not replaced, the phyſician will appear defective in his art; and if they are replaced, the patient is nearer his death than recovery.

Although fractured bones ought to be replaced as ſoon as they poſſibly can, yet a reduction of them is not to be deſpaired of even ſeveral days after the accident. Hippocrates [d], treating of a fracture in the bones of the cubitus, having firſt deſcribed the method of binding up the fractured limb, ſays; that by the ſeventh day the fractured part becomes ſo ſlender, the whole tumour diſappearing, that the fractured bones may be then very eaſily reduced to their proper places, if they have receded from thence, or were not rightly adapted in the beginning. Hence it appears, that fractured bones may be replaced and conjoined together, after ſo long an interval of time.

[d] De Fracturis Text. XLI. Charter. Tom. XII. pag. 178.

SECT.

SECT. CCCLI.

IF the fragments are looſe, they are to be taken out, when that can be eaſily performed. If any protuberant ſplinters or ſharp points of the bone plainly hinder the extenſion, if they are within ſight, they muſt be cut off; or if they lie concealed, they muſt be firſt expoſed by inciſion. If the fracture is compound, and much complicated, and eſpecially if attended with a violent contuſion, ſplintering of the bones, or a deſtruction of the larger veſſels, it requires an immediate amputation of the limb, if nothing forbids.

The fragments and ſplinters of the bones create much trouble and difficulty in the cure of fractures, eſpecially when their ſharp points injure the adjacent ſoft parts. This too frequently happens, when the tibia, and fibula are broke at the ſame time; and it is very evident, that even the worſt conſequences may from thence ariſe, if thoſe fragments irritate the tendons and muſcles while the limb is extending. It is therefore a juſt concluſion that theſe fragments ought to be removed, eſpecially if they are free on all ſides from any coheſion; for then they impede the cure like any foreign body. Yet the ſurgeon ought always to examine firſt, whether the fragments may be extracted without much difficulty, or without offering any great injury or irritation to the adjacent parts: otherwiſe they ought rather to be left to themſelves, ſince they will be afterwards ſeparated and caſt out ſpontaneouſly. Celſus [a], in treating on this ſubject, ſays: *Si id majus eſt, membranuliſque cingitur, ſinere oportet has ſub medicamentis reſolvi.* "If the fragment "is large and covered with membranes, it is beſt to

[a] Lib. VIII. cap. 10. pag. 540.

"let

" let it looſen under thoſe membranes by the uſe of " medicines." But Hippocrates [b] obſerves, that thoſe medicines cauſe theſe fragments to ſeparate the moſt ſpeedily, *Quibus celerrimæ ſuppurationes fiunt, et quibus celerrime ac optime caro increſcit: etenim increſcentes carnes in parte vitiata ut plurimum oſſa attollunt.* " Which the ſooneſt cauſe a ſuppuration, and which " the beſt and moſt ſpeedily procure an incarnation: " for the fleſh growing up in diſordered parts gene- " rally raiſes up the bones." And in another place [c], treating of that caſe where there is ſome part unexpectedly caſt off from the bone, he ſays: *Signum eſſe oſſis abſceſſuri, ſi pus copioſius ex ulcere profluat, et quaſi ad exitum feſtinet* (ἢ ὀργὰν φαίνεται) " It is a " ſign that ſome part of the bone is about to be caſt " off, if the matter is copiouſly diſcharged from the " wound, and runs haſtily in a manner to its orifice " or opening." Parey [d] predicted in himſelf that ſome part of the bone would be caſt off when he obſerved the lips of the wound ſwell, diſcharge a thin and crude ichor, and the circumjacent fleſh appear ſoft like a ſponge. But what conſiderable fragments are ſometimes thus caſt off by the aſſiſtance of nature only, is evident from the inſtance alledged in the commentary on § 343.

If any protuberant ſplinters or ſharp points, *etc.*] Sometimes it happens that the extremities of the fractured bones are ſharp pointed, which is by Celſus [e] deſervedly pronounced to be one of the worſt ſpecies of fractures, becauſe they cannot be eaſily retained in their ſituations after they have been reduced, and becauſe they wound the adjacent parts. If then the extenſion of the limb is prohibited by theſe ſharp points of the bones, nothing more remains than to cut them off if they ſtick out. Celſus [f], in treating on this ſubject, ſays: *Si acutum, ante acumen ejus, ſi*

[b] De Fracturis, Charter. Tom. XII. pag. 254. [c] Ibid. pag. 240. [d] Livre XV. Chapit. 25. pag. 346. [e] Lib. VIII. cap. 7. pag. 524. [f] Ibid. cap. 10. pag. 539.

longius

longius eſt, præcidendum; ſi brevius, limandum, et utrumque ſcalpro lævandum: tum ipſum recondendum eſt, etc. "If the ſharp point ſticking out from the edge "of the bone is long, it ſhould be cut off; but if "ſhort, it is to be raſped or filed away, and both "the points and edges are to be reduced to an even "ſurface by a ſcalprum: and after this the bone itſelf "is to be replaced," &c. Hippocrates [s] obſerves, that the eminences of fractured bones are to be cut off if they are offenſive, appear naked and troubleſome, or wound the fleſhy parts; and then he ſays: *Reliqua vero non multum refert, præcidantur necne: ſcire enim certo licet, oſſa, quæ ex toto carne nudata ſunt, et arida, omne penitus abſceſſura: a quibus autem ſquama ſeparabitur, illa præcidere non oportet, etc.* "But as for the reſt of the fragments, it matters not "much whether they are cut off or not; for you "may be very well aſſured that the bony parts "which have been laid quite bare of their fleſh, and "become dry, will all entirely exfoliate or be caſt "off: but one ought not to cut off a part of the "bone which will ſeparate or ſcale," &c. And even though it may ſeem cruel, yet it will be neceſſary to cut through the whole integuments, and remove theſe fragments when they wound the adjacent parts, or prevent the due extenſion of the broken limb. The common people uſually believe, that ſurgeons, being hardened in their practice, are often regardleſs of the miſeries of others, and ſometimes uſe the knife and cautery where more gentle methods would ſucceed with equal ſafety, though more ſlowly. But as they themſelves are ſubject to the like calamities and diſorders, it is hardly credible that they ſhould prefer a ſeverer to a more gentle method, even upon themſelves, if there were not important reaſons to urge it. But Parey, having received a very bad fracture of the leg, adviſed the expert ſurgeon who attended him not to ſpare him as a friend, but to enlarge the

[s] De Fracturis. Charter. Tom. XII. pag. 256.

wound

wound by the knife, that the bones might be more commodiouſly replaced, and the ſplinters be extracted by his fingers, at leaſt ſuch as were found unattached to the adjacent parts [h].

If the fracture is much compounded, &c.] If the laceration and deſtruction of the parts is ſo great, as to totally deſtroy the vital circulation of the humours through them, there are then no hopes left, but the whole will be in a little time corrupted: whence there only remains but one remedy in this caſe, namely, to extirpate the part thus affected; provided there is reaſon to hope that it may be performed without deſtroying the patient's life. For as the ſeparation of the corrupted parts and the union of thoſe which have been divided, depend on the circulation of healthy juices, through ſound veſſels; therefore if any of the larger veſſels are injured, or have their ſtructure deſtroyed by a violent contuſion, ſo as to aboliſh the motion of the humours through the injured parts, there can be then no hopes of ſucceſs without extirpation. But it muſt be well remarked, that this laſt and dangerous remedy ought not to be put in practice till we are aſſured there is no life remaining in the part; for we are taught by ſurprizing inſtances, that life has ſometimes returned into the parts when they have been adjudged to be perfectly dead; and therefore it is beſt to wait at leaſt a day or two, and in the mean time to treat the injured parts well with ſuch antiſeptic fomentations as may preſerve them from putrefraction, ſince we are provided with ſuch remedies of this nature by art, in which we may confide, as was ſaid before under the cure of contuſions. But to ſhew that we ought not immediately to have recourſe to extirpation in the worſt kind of fractures, it will be ſufficient to alledge the wonderful caſe which we mentioned in the commentary to § 343. A man had the tibia and fibula miſerably fractured by the wheels of a carriage loaded with ſeveral thouſand weight

[h] Ambr. Paré Livre XV. Chapit. 23. pag. 334.

paſſing

paſſing over his leg, which made ſuch a violent contuſion and laceration of the parts, that the whole limb might have been eaſily cut off with one cut or two of the ſciſſars. The bones were quite laid bare of all their integuments, a profuſe hæmorrhage much weakened the patient; and all the circumjacent parts being miſerably contuſed, ſwelled greatly, inſomuch that there was ſcarce any apparent hopes of preſerving life in the parts thus egregiouſly injured. But after replacing the bones, a large ſuppuration followed, attended with a great tumour and a cadaverous ſmell, which denoted the worſt conſequences to be thence feared; and therefore it was not without reaſon that a very ſkilful ſurgeon, who was conſulted, adviſed to amputate it. But the other ſurgeon, who had attended from the firſt of the accident, confiding in the patient's ſtrength and good habit, with the favourableneſs of the ſeaſon of the year, there being neither fever nor great pain, was bold enough to defer this ſevere and hazardous remedy, and by continually fomenting the injured parts with wine or its ſpirit, he prevented any putrefaction. After two months time a large portion of the os tibiæ was ſeparated and caſt out, while the fragments of the fibula in the mean time united. The loſt part of the tibia was repaired with good callus, ſo that in the ſpace of a year the cure was compleated, and the limb perfectly recovered its uſe without any deformity, notwithſtanding the enormous injury it had received [1].

SECT. CCCLII.

THE reſtitution of the fragments to their proper places, is performed, by turning round the part ſo gently, ſlowly, and cautiouſly after it is duly extended (349,) and prepared (351,)

[1] Traité complet de Chirurgie par. M. de la Motte, Tom. IV. pag. 284,——290.

that

that the parts of the bone may correſpond properly with each other, and then let the diſtorted muſcles be replaced in their proper ſeats, and all without intercepting any of the ſoft parts.

The ſurgeon who undertakes the cure, commits the extenſion of the fractured part to the other aſſiſting ſurgeons, or to ſervants; but the replacing of the fragments while the part is duly extended, is his own proper buſineſs; ſince the neatneſs of the cure depends entirely thereupon. Hence Hippocrates [a] obſerves, that the patient is to be ſo placed, that the affected part may be oppoſed to the light, that in its extenſion the operator may diſcern whether it continues nearly enough in a right line. If then the extenſion is ſo far continued, that the bones, which before rid over each other, can be reduced to their priſtine ſituations without injuring the circumjacent parts, then the ſurgeon may direct and replace the fragments by the action of his hands and fingers upon the fractured parts. It muſt be here well remarked, that it is not ſufficient to bring the bones together in contact, but it is neceſſary to place the fragments in the very ſame poſition which they had before the fracture: As for example, when the os humeri is fractured, the ends of the bone may be ſo adapted that the arm will remain twiſted, and the ſituation and direction of all its muſcles altered and diſturbed, whence might follow a great deformity of the limb, with a depravity of the uſes of the affected parts. Great caution is therefore neceſſary in this caſe, and the work muſt not be done too much in a hurry; for it will be much more difficult to correct afterwards an error that has been once committed. But when a due extenſion has been made, the muſcles attached to the bones, uſually reduce the fragments to their proper places by their contraction, ſo ſoon as the extenſion is

[a] De Fracturis Textu 17. Charter. Tom. XII. pag. 166.

remitted; or if they ſhould be embarraſſed or twiſted, the ſkilful ſurgeon may correct and help them, by gently turning and preſſing on them with his hands.

It muſt alſo be remarked, that the extended part muſt not be let looſe all of a ſudden, and at once, but by degrees; for otherwiſe there would be danger of intercepting ſome of the adjacent parts betwixt the fragments of the bones, which would prevent their union, and excite pain, inflammation, and other bad ſymptoms, as is ſufficiently evident.

SECT. CCCLIII.

THAT the bones are thus properly reduced, the ſurgeon knows from the anatomy of the parts, by comparing the affected part with that which is found, by the removal of the pains, and by the reſtitution of the part to its natural figure and length.

After it is judged that the fragments have recovered their proper ſituations, it muſt be carefully examined, before the bandages are applied, whether the reduction of the fragments is ſuch, that the other adjacent parts alſo retain their natural ſituations; and then it is uſual for the ſurgeon to aſk the phyſician preſent to examine the whole. But that they are thus replaced is known,

From anatomy.] For it is from thence that we are acquainted with the ſituation and figure of the bones. And in ſuch parts where the uncovered bones may be eaſily felt, one may eaſily diſcern whether the fragments deviate from their proper ſituations: As for example, by moving the fingers down the whole length of the ſpine of the os tibiæ. But it is not ſo eaſy to diſcover this in other parts, where the bones are covered with thick muſcles.

By a compariſon of the ſound part.] This is a method of the laſt importance in order to determine certainly, whether the fragments are rightly replaced. For example, if the bones of the leg are fractured, after reducing them, the diſeaſed leg is to be compared with the other which is ſound, and a careful examination muſt be made, whether the ſame cavities, protuberances, *&c.* appear in each alike. For the bulk and poſition of the muſcles it is that gives the ſhape of the limb; and if theſe appear altogether the ſame in the affected and in the ſound limb, we may be certain that all the parts retain their proper ſituations. This is what Celſus [a] ſeems to intend, when he ſays, that after the bones have been reduced to their proper places: (*At membrum alteri æquatum, involvendum duplicibus triplicibuſve pannis, &c.*) "The "limb appearing uniformly like the other, is to be "rolled up with cloths two or three times doubled," *&c.*

The removal of the pain.] When the fragments ride over each other, it is impoſſible but the adjacent parts muſt be preſſed and diſtracted; and if the fragments are ſharp pointed, they muſt neceſſarily prick and lacerate thoſe parts; whence it is ſufficiently evident from what cauſe ſuch excruciating pains frequently ariſe in fractures. But ſo ſoon as the bones are reduced, the cauſe of this pain then ceaſes, and therefore the pain itſelf immediately goes off, or at leaſt is much abated, (ſince a violent contuſion or laceration of the parts may ſometimes cauſe the pain to remain after the bones are well reduced:) and then we are aſſured, that no parts are intercepted betwixt the fragments if the pain ceaſes. Hence Celſus [b] lays it down as a poſitive rule, *Indicium oſſis repoſiti eſt dolor ſublatus*; "That if the pain is removed it is a ſign the "bone is reduced."

By a reſtitution of the part to its natural length and figure.] This may be known by comparing the

[a] Lib. VIII. cap. X. pag. 532, 533. [b] Ibid. pag. 532.

part injured with that which is ſound: for if the fractured bones *non adverſa, ſed obliqua junguntur (quod fit, ubi loco ſuo non ſunt), membrum id altero latere brevius eſt, & muſculi ejus tument*; "are not "joined oppoſitely but obliquely, which happens "when they are diſplaced, the limb is then ſhorter than "that of the other ſide, and its muſcles ſwell [c]."

But great circumſpection is required in comparing the fractured with the ſound limb; ſince the moſt ſkilful have been ſometimes deceived in this reſpect. A man broke his thigh-bone near the neck, whence the fracture was at firſt miſtaken for a luxation. The fragments being replaced (as was imagined) in their natural ſituations, the ſurgeons compared the length of the injured limb with that which was ſound, and the injured was found ſhorter than the other: but as it could be pulled as long as the other ſound limb without any violence, nothing amiſs was ſuſpected. Yet the patient halted after the cure, and the fractured limb was apparently ſhorter than the other. When they examined again and extended both the legs as the patient lay on the bed, they found that without difficulty the injured leg might be extended as long as the other; and they then found, that the os ilium of the affected ſide had deſcended in the firſt extenſion, and ſo gave the appearance of a falſe equality in the two limbs; ſince the flexibility of the loins eaſily permits the os ilium to deſcend with the extended thigh. Therefore when the ſurgeon examines whether the length of the injured leg is equal to that of the ſound one, he ought to be certain that the oſſa ilii on each ſide are placed in the ſame line of altitude [d]; for it is poſſible the patient may elevate or depreſs the os ilium of one ſide to avoid pain.

[c] Lib. VIII. cap. X. pag. 532.

[d] Academ. des Sciences l'an. 1722. Mem. pag. 450. 451.

SECT.

SECT. CCCLIV.

THE retention of the bones in their ſituations is performed with bandages, compreſſes, and ſplints, by keeping the limb at reſt in a box or caſe, and by preventing or directing the action of the muſcles.

It is often much more difficult to retain the reduced fragments in their proper ſituations than is commonly imagined; and it is in this part of the cure of fractures, that the ſkill and dexterity of the ſurgeon are principally apparent. For the muſcles attached to the bones may by their contraction diſplace the fragments out of their natural ſituations; and the ſame accident may alſo ariſe from coughing, ſneezing, moving the limb in ſleeping, *&c.* which laſt is a circumſtance lamented by Parey [a], *viz.* that in his ſleep the muſcles being ſtrongly contracted elevated his broken leg, whereby the fragments were immediately removed from their contacts, and made it neceſſary to replace them again by a new extenſion, not without extreme pain followed by an inflammation, fever, and ſuppuration. It is therefore neceſſary to ſo ſecure the injured limb, as that it may continue quite immoveable. But this is effected,

By bandages.] Various bandages are applied to fractured limbs, according as the dreſſings are required to remain a longer or a ſhorter time upon the parts before they are renewed. In a ſimple fracture a ſpiral bandage with one or two heads is ſufficient [b]. But when a wound, violent contuſion, inflammation, *&c.* attends the fracture, it would be inconvenient to remove this apparatus every day to treat the affected parts with proper remedies; for the injured limb muſt

[a] Livre XV. Chapit. 25. pag. 346.

[b] Heiſter. Inſtitut. Chirurg. Tab. 2. lit. b. c.

be lifted up in order to take off and re-apply the ſpiral turns of the bandage; but this can ſcarcely be done without danger of diſplacing and ſeparating the fragments from each other. Therefore another method has been contrived by ſurgeons, namely a foliated bandage with eighteen leaves or heads, as they are often called; being formed of three pieces of linen laid over each other, and cut into three parts by two ſlits on each ſide; but ſo however that the piece of linen next the limb is the ſhorteſt, the other a little longer, and the outermoſt the longeſt of them all. This foliated bandage being moiſtened with oxycrate, or ſome ſuch liquor, is placed under the injured part, and then the two middle leaves or heads of the innermoſt piece of linen are firſt applied over the part croſſing each other, and then the reſt of the leaves croſſed over each other ſucceſſively in the ſame manner. Soth at it is neceſſary for the pieces of linen to be long enough to exceed a little the thickneſs of the limb to wrap over. But a better idea of this bandage may be had from figures than from any deſcription alone, for which conſult Heiſter [c], and others who have treated on bandages. But though this bandage is reckoned a modern invention, there ſeems to be one of the like make deſcribed in Hippocrates [d]. For in caſes where he expected any large fragment to ſeparate or be caſt out, he orders to take double cloths of the breadth of half a ſpan, not leſs; but a little ſhorter in length than to go twice round the limb, and at leaſt much longer than to go once round: and let theſe cloths be as many in number as the caſe may require. Having dipt theſe in black auſtere wine, he would have them applied to the middle of the affected part, in the manner uſual for applying bandages with two heads; then proceed to croſs the heads over each other, the right towards the left and the left towards the right; nor does he order them

[c] Inſtitut. Chirurg. Tab. IX. fig. 4. & Tab. XXXVIII. fig. 25. & pag. 1244. [d] De Fracturis Charter. Tom. XII. pag. 241, &c.

to

to be in the leaſt tightened, but to be diſpoſed ſo as that the wound may appear. Galen, in his explanation of this text of Hippocrates, gives almoſt the ſame deſcription of this foliated bandage. And yet Celſus, in the cure of a fracture accompanied with a wound of the ſoft parts, makes no mention of any ſuch bandage; but he only directs to make the deligation of the part more looſely than if it was not wounded; and rather to increaſe the number of bandages, that they may ſecure it equally, though looſely[e]. The great uſefulneſs of this bandage conſiſts in admitting the dreſſings to be renewed, in order to cure the wound without taking off the bandage.

But the neceſſary qualities of bandages in general are beautifully repreſented by Hippocrates[f], when he ſays, *Faſciæ parandæ ſunt leves, tenues, molles, mundæ, latæ, nullas ſutaras, neque eminentias habentes, ſatis validæ ut extenſionem ferant, pauloque fortiores, non aridæ, ſed ſucco madentes, quo quæque inebriari conſueverunt*; "Bandages ought to be provided which are "light, thin, ſoft, clean, broad, and without any "ſeams or eminencies, of a ſufficient ſtrength, that "they may bear a little ſtronger force than that ap-"plied to extend them; nor are they to be uſed dry, "but moiſtened with ſome liquor, in which it is uſual "to dip them."

It is ſufficiently evident, that the foliated bandage before deſcribed does not ſo firmly retain the parts as that which is made by ſpiral circumvolutions; and the wound, ulcer, or violent contuſion, which accompanies the fracture, would not ſupport ſo violent a compreſſure, and therefore the foliated bandage is in this caſe ſufficient. The ſpiral bandages have principally this advantage, that they retain the replaced fragments in their ſituations by an equable preſſure; and therefore it is that ſurgeons uſually bind up the fractured part with a ſpiral bandage at firſt; and if,

[e] A. Corn. Celſi Medic. Lib. VIII. cap. 10. pag. 539. [f] De Medici officina Charter. Tom. XII. pag. 62.

for example, they carried this firſt bandage from the left to the right, they then began with another ſpiral bandage upon the part, and carry it from the right to the left, in order to make the more equable preſſure, and to act principally upon the fractured part. All which is again beautifully deſcribed by Hippocrates[g], who ſays, treating on the cure of fractures of the bones of the cubitus, *Poſtea oportet faſcia deligare, principio ſupra fracturam injecto, ſic ut firmet quidem, non tamen vehementer comprimat. Ubi bis vel ter ſic faſciam ſuperduxerit, ad ſuperiora diſtribuat, quo ſanguinis affluxus intercipiatur, ibique deſinat. At primas faſcias minime longas eſſe oportet, ſecundarum vero initium ſupra fracturam injiciendum eſt, ut ſemel circa illam revolvatur, tum deorſum demittatur, lenius adſtringatur, atque ex majori intervallo circumdetur, &c.* "After "this you muſt make your deligation with a bandage, "fixing the end of it upon the fracture, ſo that it "may hold faſt, but not violently compreſs the parts. "After two or three turns thus made with your bandage upon the fracture, carry it upwards, to prevent "the too great afflux of blood, and there let it terminate. As for thoſe bandages which are to be the "firſt applied, they ought to be not ſo long, but the "beginning of your ſecond bandage is to be faſtened "upon the fracture and paſſed once round it, and then "let it be carried downwards, tightening it gently, "and making your circumvolutions at larger intervals, *&c.*" In the ſame place he has alſo ſeveral other uſeful admonitions concerning the uſe of bandages, as alſo in Celſus[h].

Compreſſes.] It is an admonition of Hippocrates[i], that *probe noſſe oporteat, omnem faſciam ad declivia & acuminata diffugere, ut in capite ſurſum, in tibia deorſum.* "It ought to be well obſerved, that upon ſuch "parts as are acuminated, or have any declivity, all

[g] De Fracturis Charter. Tom. XII. p. 169—173. [h] Lib. VIII. cap. 10. pag. 533. [i] De Medici officina Charter. Tom. XII. pag. 48.

"bandages

" bandages looſen or fly off, as in the head upwards, " and in the leg downwards." And therefore in another place he ſays [k], *quæ extremitate tenuantur, ſpleniis æquanda ſunt in orbem datis, &c.* " Thoſe " parts which are tapering towards their extremities, " are to be made even with compreſſes rolled up," *&c.* Compreſſes have therefore this principal uſe, that being properly applied, they give the affected parts a cylindrical figure, that the bandages may hold the faſter, and not ſlip off of their own accord towards a ſmaller end of the limb. Alſo when, for example, the end of the broken os femoris recedes outwards, in that caſe the preſſure of the bandage may be ſo determined by the application of compreſſes, as to act more upon the receding part, and by that means prevent the fragments of the bone from being eaſily diſplaced again that way, by the action of the muſcles, or of any other cauſe. But of what a conſiderable uſe compreſſes are in directing and preventing the action of the muſcles we ſhall preſently declare.

Splints.] Tho' the injured part may be well ſecured by compreſs and bandage duly applied, yet they will not prevent the limb from bending in the part fractured, if it ſhould be moved in ſleep, or by ſome accident; whence the ſituation of the replaced fragments would be diſturbed. For this reaſon ſurgeons fix ſplints, of thin wood or thick paſteboard (board paper) round the limb, to prevent this accident. Theſe ſplints are required to be firm enough to hinder the bending of the limb in the fractured part; being ſuch as may be eaſily adapted to the figure of the injured part, and are at the ſame time ſo light, that they prove no incumbrance by their weight. But becauſe the hollow ſtalks of the plant ferula, being very light, and yet ſtrong, induced the ancients to uſe them for this purpoſe, it is from thence that this part of the apparatus for the cure of fractures, has acquired the name of ferulæ or ſplints.

[k] De Fracturis Textu, 34. Charter. Tom. XII. pag. 173.

Hip-

Hippocrates[l] treating of them, ſays: *Ferulæ autem ſint leves, æquales, in extremis ſimæ, hinc & illinc parum minores deligatione; craſſiſſimæ autem, qua exſtat fractura.* "But let your ſplints be light, and of the "ſame ſize, with obtuſe or rounding ends; being a "little thinner in thoſe parts where they are to be "tied on, but thickeſt where they cover the frac-"ture." The ſplints are faſtened on by ſlight ligatures only, becauſe they are not applied to preſs, but only to defend the bandage, as Hippocrates prudently obſerves in another place[m]; where he alſo adds, that care muſt be taken not to injure the prominent parts, which are not defended with fleſh, by the application of the ſplints; for from thence might follow an ulcer, and the tendons might be laid bare. Hence he orders, in a fracture of the cubitus, not to place the ſplints by the ſide of the thumb or little finger, or if it is neceſſary to apply them ſo, let them be very ſhort; for otherwiſe the prominent ends of the radius and ulna near the wriſt would be injured. The ſame is true likewiſe in a fracture of the leg: namely, care muſt be taken not to let the ſplints touch the ancles, nor the protuberant parts of the tibia and fibula at the knee: for the whole preſſure of the ligatures retaining the ſplints in their places, would be returned upon thoſe parts only. I have ſeen an error of bad conſequence, when the ſurgeon has neglected this caution; for a gangrene was produced at the ancles and knee, barely by the preſſure of the ſplints upon thoſe parts. But it is evident from what has been ſaid before, that if only one bone is broke in thoſe parts which have two, that then ſplints are not always ſo very neceſſary to be uſed. This is well obſerved by Celſus[n], who ſays almoſt the ſame with Hippocrates concerning ſplints. *Curioſius omnia in continendis oſſibus fiant, ſi neutrum alteri auxilio eſt. Nam,*

[l] De Medici officina, pag. 79. Charter. Tom. XII. [m] De Fracturis Textu 14. Charter. Tom. XII. pag. 179. & de Medic. officina ibid. pag. 80. [n] Lib. VIII. cap. 10. pag. 536.

ubi

ubi alterum integrum eſt, plus opis in eo, quam in faſciis feruliſque eſt. "Every thing muſt be conducted "with greater care and exactneſs for retaining the "bones, when one affords no ſupport to the other: "But when one of them remains whole, it will of "itſelf be of more ſervice than even bandages and "ſplints." From the places before cited from Hippocrates and Celſus, it appears that they did not apply the ſplints before the ſeventh day: but the modern ſurgeons apply them at the firſt dreſſing, which Parey [o] took care to have put in practice upon himſelf.

Box or caſe.] It is alſo further required to retain the injured limb ſo ſecurely that it may remain immoveable, and as eaſy as poſſible; and as it is neceſſary for the limb to continue thus always in the ſame poſture, therefore the injured parts are to be ſo diſpoſed, that they may continue a long time at reſt with the leaſt uneaſineſs. Thus, for example, in a fracture of the leg or thigh, the articulation of the knee ought to be a little inflected; for no body can lie a long time with their leg extended. In the next place, the limb is to be ſo ſupported by pillows, that its weight may be ſuſtained by the whole length and lower ſurface of the limb, and not by one or two parts only; for that might occaſion an inflammation and a gengrene of the parts too much preſs'd. Thus a gangrene of the worſt kind has been ſometimes obſerved to invade the heel from this cauſe only. And Hippocrates [p] obſerves, that by a too long lying of the limb upon the heel, the os calcis itſelf becomes at length corrupted, and is a caſe that may be attended with the greateſt danger; becauſe when this bone is corrupted, the diſorder may continue as long as the patient lives. To avoid this accident Hippocrates [q] adviſes in another place, to fix the broken leg after it is bound up upon a ſoft plane, ſo that it

[o] Livre XV. Chapitre 23. pag. 344. [p] De Fracturis Charter. Tom. XII. pag. 200, 201. [q] Ibid. pag. 217.

may

may neither incline to one ſide nor the other, nor riſe higher before than behind, nor be apt to turn eaſily any way. For if the limb is not ſuſtained by its whole length, but preſſes only upon the heel and knee, an incurvation may follow in the fractured part, from the weight of the other parts. The ſame incurvation may alſo follow, if the fractured part is ſuſtained, but the foot and heel are permitted to deſcend lower than the reſt of the leg. But as for the caſes uſed to retain broken legs from moving any way, Hippocrates [r] conſeſſes that he knows not what to ſay of them. They may indeed be of ſome uſe, but not ſo ſerviceable as is commonly imagined: for if the body is turned to either ſide, the caſe will not hinder the leg from following, if the patient himſelf is not cautious to prevent it; nor will it prevent the leg from being moved even without any motion of the body. But he adds, that the operator will be leſs liable to blame from the vulgar, if he uſes one of theſe caſes. But the modern ſurgeons have contrived very beautiful machines for the commodious placing and retaining a fractured limb from being moved; and which at the ſame time eaſily permit the dreſſings to be renewed in complicated fractures. Such a caſe for the retention of a broken leg, is deſcribed in the Mem. Acad. Reg. Scient. [s], and the figure and deſcription of it may be alſo ſeen in (tab. ix. lib. 11. cap. 10. § 2.) the ſurgery of the celebrated Heiſter. A commodious diſpoſition of the injured limb, and of the reſt of the body is evidently of the greateſt importance towards a cure in fractures, where the patient is obliged to lie ſo long a time; and therefore the moſt ſkilful ſurgeons themſelves ſtoop to lay the patient's bed as it ought to be [t], that they be aſſured all is right.

[r] De Fracturis Charter. Tom. XII. pag. 217. [s] l'an. 1718. Mem. pag. 396. [t] Traité complet de Chirurgie, par M. de la Motte, Tom. IV. pag. 179.

By

By preventing and directing the action of the muſcles.]. In this the ſkill of the ſurgeon is principally apparent: for when the bones are fractured, the direction of the muſcles attached to them is diſturbed, if not prevented by art, and by contracting they will diſplace the fragments. Thus for example, if the radius is fractured, the pronator quadratus, and the ligament betwixt the radius and ulna will contract the fragments of the former towards the latter; and this injury will be ſtill augmented by the preſſure of any bandage. But if compreſſes are placed betwixt the radius and the ulna, this will occaſion the preſſure of the bandage to be returned chiefly upon the compreſſes, and they may prevent the radius from approaching towards the ulna. The ſame may alſo take place in a fracture of the fibula. But when the bone is fractured into ſeveral pieces, there is danger leſt the contraction of the muſcles ſhould thruſt out the fragments, by which means the limb might afterwards become ſhorter: and therefore, in ſuch a caſe, it will be neceſſary to preſerve the due length of the injured part by the application of machines that prevent contraction, till the uniting of the fragments and ſtrength of the muſcles prove ſufficient for the reſiſtance. But of this we treated in the commentary on § 346. That there is often no ſmall difficulty in the deligation of theſe fractures has been well obſerved by Hippocrates[a], who in treating of a fracture of the heel, ſays, that it not every one who is able to make a proper deligation in thoſe caſes; for if the common bandage of the ancle is applied, by paſſing the roller about the foot and tendon Achilles, the preſſure of the bandage would again diſplace the calcaneum. And then he proceeds to deſcribe the beſt method of deligation in the ſame caſe; from whence it is evident how extremely neceſſary it is to have a knowledge from anatomy of the adjacent tendons and muſcles, in the cure of fractures.

[a] De Fracturis Charter. Tom. XII. pag. 199.

SECT.

SECT. CCCLV.

TOO tight bandages intercept the circulation, ſo as to produce a tumour and a gangrene; from whence follow infinite diſorders: they ought therefore to be gently tightened, ſo as to hold firm, and but moderately preſs upon the ſmall veſſels.

Great injuries often ariſe from too ſtrict bandages, made with a deſign to retain the replaced bones. For it commonly happens that the fractured limb begins to ſwell within a few hours time, and eſpecially about the part of the fracture; whether the tumour be a conſequence of the fracture, contuſion, or the rough treatment of the part, in order to replace the bones, and make a due extenſion: ſo that if the bandage was too tight at firſt, before this tumour appeared, it is evident that as the tumour ariſes the preſſure of the bandage will increaſe; whence follow an obſtruction of the compreſſed veſſels, an inflammation, or even a total ſtoppage of the circulation and a gangrene. Intenſe pains often ariſe from the too great ſtricture of bandages; but if the ſurgeon neglects the patient's complaint, he often finds his error in a gangrene of the part, which being corrupted, can be only remedied by extirpation. Hence all ſkilful ſurgeons carefully admoniſh to enquire into the cauſe of the patient's pain when he complains, and rather to remove all the dreſſings, than to ſuffer a deſtruction of the affected part, or even hazard the patient's life. The bad events of ſuch a neglect have been frequently obſerved, and ſeveral inſtances are related by the celebrated le Motte[a]. It will be, therefore, the leaſt hurtful of the two to make the bandage over ſlack than too tight, becauſe the former may be corrected

[a] Traité complet. de Chirurgie, Tom. IV. pag. 272, &c.

by

by the application of a ſecond bandage. But the ſigns by which one may know whether there is a ſufficient ſtricture made by the bandages, are very well enumerated by Hippocrates [b], where he ſays, *Signa autem rectè curati hæc ſunt, & terminus deligandi. Si rogaveris, an prematur, & dixerit, ſe premi quidem ſed leviter, & maximè circa fracturam. Moderationis autem indicia ſunt, ſi illa die, qua deligatas fuit ac nocte, ipſe ſibi videatur non levius, ſed valentius adſtringi, poſtridie autem parvus tumor* (ὀιδημάτιον) *in manu oriatur & mollis. Signum enim hoc tibi erit moderatæ adſtrictionis. Labente jam die minus adſtrictas faſcias ſentiat, ſed tertio die laxas omnino. Scire autem licet, ſi quid ex dictis abſit, quod juſto laxior ſit deligatio, ſi quid ex dictis ſuperet, plus juſto fuiſſe adſtrictam.* "But the "ſigns which denote that the fracture hath been "rightly treated, and the deligation duly made, are, "if upon enquiry the patient affirms, that he feels a "ſtricture, though but a gentle one, and eſpecially "about the part fractured. And it is a ſign the "bandage is not too tight, if within the firſt day and "night after the dreſſing, the patient feels the ſtric-"ture not diminiſhed, but rather increaſed, and the "day after a ſlight and ſoft or œdematous ſwelling "appears in the hand or lower part. The ſecond "day being elapſed, the patient feels the ſtricture "of the bandage diminiſhed, and on the third day "it ſeems to be quite looſe. But you may obſerve, "if any of the foremention appearances are ab-"ſent, that then the deligation is looſer than it ought "to be, or if they exceed beyond this deſcription, "then the bandage has been applied too tight." If that tumour which invades the inferior part of the limb below the bandage appears ſmall, ſoft, and white, it denotes that the veins are but ſlightly compreſſed, from whence, with the inactivity of the part not forwarding the blood through the veins, it is

[b] De Fracturis Textu 37. Charter. Tom. XII. pag. 175, &c. & de Medici Officina ibid. pag. 95.

that

that the tumour itſelf ariſes; but when the parts are ſwelled above the bandage, it is a ſign that the arteries are likewiſe compreſſed, which may produce an inflammation or a gangrene. But when on the third day the bandage appears ſpontaneouſly relaxed, by the diminution of the ſwelling in the parts, Hippocrates[c] then orders the bandages to be drawn a little tighter, and to repeat the ſtricture likewiſe on the ſeventh day, if it ſhall be found neceſſary; always obſerving the cautions before given. But when the dreſſings are removed, it ought always to be carefully examined whether any of the fragments have receded from their natural ſituations, as we ſaid before at § 353.

SECT. CCCLVI.

IF there are any wounds accompany the fracture, they are to be treated according to the rules of art, as mentioned from § 185 to 239, but they ſeldom admit of deligation. The ſame is alſo to be underſtood of an inflammation, pain, tumour, and other ſymptoms attending.

If ſo conſiderable a wound attends a complicated fracture, that it cannot be ſafely left to nature; then the foliated bandage, with eighteen heads or leaves, ought to be uſed, that the wound may be commodiouſly treated without danger of ſeparating the fragments. 'Tis true, this bandage does not ſo firmly retain the part as that made by ſpiral circumvolutions; but in this caſe the wound will not permit a greater ſtricture. 'Tis an ill practice of ſome to compreſs the circumjacent parts by a ſpiral bandage, leaving the place of the wound open, or elſe by cutting out a piece of the bandage, to leave an opening over the wound: for when the circumjacent parts are com-

[c] De Fracturis Textu 40. Charter. Tom. XII pag. 177, &c.

preſſed,

preſſed, and the wound left open, the humours are derived more forcibly and copiouſly to the wounded part; whence follow inflammation, tumour, proud fleſh, and the like. Even Hippocrates [a] has condemned this method, when he ſays; *Neceſſe eſt, ulcus in tumorem aſſurgere; nam ſi ſana caro hinc atque hinc vinciatur, in medio vero non maxime ibi tumebit, et colorem mutabit, quomodo ergo ulcus hæc effugiet? neceſſe ergo eſt, ulcus decolorari, et materiam huc exprimi, unde lacrymabitur et non ſuppurabit, oſſa vero et quæ abſceſſura non eſſent, abſcedent*; "It muſt ne-
" ceſſarily cauſe the wound to riſe up into a tumour;
" for even if ſound fleſh is compreſſed or bound on
" all ſides, and left free in the middle, it will there
" ſwell greatly, and alter its colour; how then is it
" poſſible for the wound to eſcape theſe? The wound
" muſt therefore of neceſſity be diſcoloured, and the
" juices will be there forced out, whence it will not
" ſuppurate, but weep or diſtil a ſharp water, and
" bones will be ſeparated or caſt out which ought to
" have been retained." And he afterwards adds, that he ſpeaks of this the more largely, that every body might reject this ill method of deligation, which was uſed by many. What elſe has been ſaid concerning the cure of wounds, ought here alſo to be obſerved; and if part of the bone is laid bare by the wound, it will be convenient to uſe thoſe methods which were propoſed under wounds of the head expoſing the cranium. But a ſeldom removing of the dreſſings convenient in moſt other wounds, as we before obſerved, will be more eſpecially uſeful in theſe; becauſe great care muſt be always taken not to diſturb the ſituation of the replaced fragments.

Now altho' an exact regimen may not ſeem to be ſo very neceſſary for a ſimple fracture in a healthy perſon, yet it muſt be obſerved, that no worſe accident can happen here, that an inflammation ſupervening the fracture; for then the bandages muſt be

[a] De Fracturis Textu 40. Charter. Tom. XII. pag. 234, &c.

taken off, and ſuch things applied as are proper to remove the inflammation, which might poſſibly have been better prevented. Phlebotomy therefore, with a thin diet, will be extremely convenient, more eſpecially in thoſe of a full habit, inclined to inflammations. Every thing muſt therefore be avoided which augment the quantity or motion of the circulating humours. But more eſpecially theſe cautions are neceſſary to be obſerved for the firſt days, when there is the moſt danger of an inflammation. Hence Hippocrates [b] pronounces; *Diæta autem illis, quibus ab initio nec vulnus adeſt, nec oſſa eminent, ſufficit non adeo tenuis et exquiſita* (ὑποφαύλη) *minus tamen cibi ſumant, uſque ad decimum diem; præſertim cum quieſcant. Adhibeantque ex obſoniis mollibus, quæ modice alvum ſollicitent, ſed a vino et carne abſtineant: poſtea paulatim ſe reficiant*; "But the diet for thoſe who from "the beginning have no wound nor diſtortion of the "bones, need not to be ſo low and exact; but let them "eat ſparingly until the tenth day, eſpecially when "they have no exerciſe. And let them uſe ſoft ſhell-"fiſh, which gently excite to ſtool; but let them "abſtain from wine and fleſh: afterwards they may "by degrees indulge themſelves." But when a fracture is accompanied with great tumour, or violent inflammation, thoſe remedies muſt be ſpeedily uſed, and boldly repeated according to the urgency of the ſymptoms, which we recommended in the cure of contuſions § 334. and at the ſame time a very thin diet will be proper.

SECT. CCCLVII.

THEN follows a concretion or union of the parts by a callus, within the ſpace of betwixt 20 and 70 days; ſooner or later, according to the age of the patient, the thickneſs of the

[b] De Fracturis Textu 45. Charter. Tom. XII. pag. 181, &c.

bone,

bone, the incumbent weight it is to ſuſtain, and the ſeaſon of the year.

The third thing required to be done in the cure of fractures in general (§ 347. numb. 3.) is to procure a union or concretion of the replaced and retained fragments with each other; and if there is any loſs of ſubſtance in the bone to procure a regeneration of it. But it has been cuſtomary with phyſicians and ſurgeons to call that ſubſtance a callus, by the interpoſition of which the fragments are united to each other. But what a callus is, and how it is generated, has been explained in the commentaries on § 343, and 347. numb. 3. For it there appears, that the divided parts are united, and the loſt ſubſtance repaired, by the ingeſted aliments converted into healthy animal fluids, derived to the parts thro' ſound veſſels, with a proper impetus, and in due quantities. Art does nothing more in this caſe, than replace and retain the fragments in their proper ſituations; for all the reſt is performed by the fabric of the healthy body. Therefore it need only be enquired whether any thing is defective with reſpect to health; and when that defect is known, to correct it by art: and in the commentary on § 346. we treated of the chief cauſes which have been obſerved to retard the cure, or render it impracticable.

But the time in which the fragments uſually conjoin, varies upon many accounts even in healthy people. And therefore Hippocrates[b] having ſpoken of a fracture of the cubitus conjoining within thirty days at moſt, adds afterwards: *Nihil autem perpetuum eſt: multum enim et natura a natura, et ætas ab ætate differt*; "But there is nothing of this conſtant; "for the natures or conſtitutions, as well as the ages "of patients are very different."

[b] De Fracturis Textu 41, 42. Charter. Tom. XII. pag. 179, 180.

But the chief difference of the time required for the cure of fractures depends on the

Age.] For in young ſubjects the conſolidation of the fracture is the ſooneſt made; but then in them often ariſes too great a luxuriancy of the callus. In old age the time required is much longer; for, at that time, the body rather decreaſes: whence it is found extremely difficult to procure a regeneration of the loſt ſubſtance, or a reunion of the divided parts in ſuch people. But a middle age is of all the beſt; for then indeed the fracture conjoins more ſlowly than in youth; but it unites more firmly; nor is there ſo much danger of a luxuriancy in the callus. It was ſaid in the commentary on § 346. that a fracture of the humerus in new born infants has been cured within twelve days time; whereas in adults the like cure requires thrice as long a time; and in old people the time required is ſtill much longer.

The thickneſs of the bone.] The bones vary in thickneſs according to the weight they are to ſuſtain, or the ſtrength of the muſcles which they are to ſupport and direct; whence again it has been obſerved, that (*cæteris paribus*) ſo much a greater length of time is required for the conſolidation of a fracture, as the bones are of a greater thickneſs. Thus Hippocrates [b] ſays, that the os femoris takes fifty days to conjoin it; the bones of the leg and humerus, forty days [c]; thoſe of the cubitus but thirty days at moſt [d]; fractured ribs require twenty days [e], and the bones of the fingers as many days [f], *etc.* Whence the cure of fractures of the bones are uſually compleated within the ſpace of twenty to ſeventy days time; ſince within that term, the os femoris, which is the largeſt bone in the whole body, is uſually conſolidated, in a healthy man of a middle age, when no ill accident oppoſes. But when large fragments are ſeparated and removed, there is then a

[b] De Fracturis Charter. Tom. XII. pag. 223. [c] Ibid. pag. 220. & pag. 191. [d] Ibid. pag. 179. [e] De Articulis ib. pag. 394. [f] De Fracturis ibid. pag. 194—197.

large

large portion of the ſubſtance of the bone to be regenerated, which will require a much longer ſpace of time: as is evident from the inſtance alledged in the commentary on § 343, where a fragment of the tibia was ſeparated, to the length of four fingers breadth; for there the ſpace of ten months was required, before the patient could ſafely ſtand upon the fractured leg.

The incumbent weight.] For the callus formed in the fractured part remains a long time ſofter than the other ſubſtance of the bone. If therefore the fractured bone is once uſed to ſuſtain the whole weight of the body, when a perſon walks, it is evident that a longer time will be required before this can be ſafely attempted. Hence a leſs time is required for the cure of the os humeri than for the bones of the leg; and more eſpecially when both bones are broken. Hippocrates [g] ſays, that a fracture of the os calcis takes ſixty days for the cure, whereas fifty days are ſufficient for a fracture of the femur: but he had before obſerved, that the os calcis is placed directly under the tibia; whence it is evident, that this bone ſuſtains the whole weight of the body. In treating of a fracture of the bones of the hand and foot he obſerves [h], that all of them are perfectly curable within twenty days, excepting thoſe bones of the foot which are connected to or placed directly under the bones of the leg: for then thirty days are required to a compleat cure, if the patient is willing to lie ſo long, as many will not, becauſe they think the diſorder trifling, and therefore it is that moſt of them are not perfectly well cured. For the feet ſuſtain the whole weight of the body.

Therefore before the patient is ſuffered to have the uſe of his limb, the prudent ſurgeon ought to examine whether the callus is ſufficiently firm in the fractured part; to do which the limb is to be taken hold

[g] De Fracturis Charter. Tom. XII. pag. 206.
[h] Ibid. pag. 195, &c.

of on each ſide the fracture by two aſſiſtants, who are then to make a gentle attempt to bend it in the part of the fracture, while the ſurgeon in the mean time applies his fingers over the callus. If now any looſeneſs or the leaſt bending of the bones can be perceived, it is a ſign the callus is not yet ſufficiently indurated; whence might follow a new fracture or a deformity and incurvation of the limb, or at leaſt the callus, being as yet ſoft, might be expreſſed from betwixt the bones by the weight of the body, ſo as to form a protuberance, which would at the ſame time diminiſh the due length of the limb. But in the mean time, as the diſeaſed limb is obliged to be kept at reſt for ſo long a ſpace, care muſt be taken not to let the adjacent articulation become rigid; becauſe an anchyloſis or ſtiff joint has been frequently obſerved to ariſe merely from a want of moving it: and therefore during the time of the cure, the ſurgeon ought prudently to move the articulation at proper intervals, not ſuffering the patient to move it, leſt by an imprudent agitation the fragments might be again diſplaced, after they have been properly reduced.

Though the fragments have been ever ſo well replaced, yet it is beſt to make a careful examination of the parts every time that the dreſſings are renewed, and to make a compariſon with the ſound limb, in order to obſerve whether they are both of the ſame length and figure: for if any defect as yet remains, it may be corrected while the callus is flexible; for when it has acquired a bony hardneſs, it will very difficultly, if at all, admit of an alteration. Whence Hippocrates [1] juſtly obſerves, *Quod ſi alligatis ferulis ſuſpicio ſit, oſſa non recta concurrere; vel aliud quid ægrum moleſtet, ubi dimidium temporis (requiſiti ad integram curationem) præterierit, vel paulo ante, ſolvere oportet, atque iterum deligare:* "That if there is any room to "ſuſpect that the bones are not properly cloſed after "the ſplints are tied on; or if any thing is trouble-

[1] De Fracturis. Charter. Tom. XII. pag. 181.

"ſome

" ſome to the patient, when half the time neceſſary " for the cure is expired, or a little before, it will " be proper to remove the dreſſings, and reapply " them again." But we need not perhaps entirely deſpair of correcting a deformity, if any remains, even after the whole time is elapſed, uſual for the cure of fractures; for obſervations confirm the poſſibility of this practice, which may ſucceed more eſpecially in younger ſubjects. A youth of ſixteen years old had a fracture of the femur, which through negligence was found, nine weeks afterwards, to be half a foot ſhorter than the other thigh; which would have occaſioned the patient to go lame all his life time: but a very ſkilful ſurgeon, examining the place of the fracture, found that the ends of the fractured bone were drawn up and conjoined by the ſides of each other. The patient being very robuſt, and the callus yet recent, induced him to cauſe the limb to be violently extended by aſſiſtants with ſlings, and by preſſing with his hands on each ſide at the ſame time, he reduced the fragments to their proper ſituations without any pain to the patient: thus the limb was reſtored to its due length ſo happily, that within the ſpace of a month afterwards the young man could walk without any manner of halting[k]. It has been even obſerved, that the fragments ſooner conſolidate in ſuch a caſe, than they unite with each other after being lately broken: which is alſo confirmed by another remarkable caſe from the ſame author[l]; namely, a man having fractured both legs, was well cured; but unluckily he broke one of his legs in the ſame place again, ſix or ſeven weeks afterwards, and within twelve days time from the reduction of the fragments, the parts were ſo firmly conjoined, that he could conveniently move and elevate the leg. This ſecond accident made the patient more cautious to avoid the like again; but three months after he was thrown

[k] De la Motte Traité complet de Chirurgie, pag. 164, &c.
[l] Ibid. pag. 242, &c.

from a horſe, and broke his leg again in the ſame place; but yet the cure happily ſucceeded, and in a ſhort time, almoſt without any deformity.

But when the ends of the fractured bones do not unite together, but in a manner cicatrize and remain ſeparated, then the caſe is much more difficult. That this accident does ſometimes happen, is evident from what has been ſaid in the commentary on § 346. And if it proceeds from a defect in the growth or nutrition of the bone, from ſome diſeaſe, there is then no remedy for it. But if the conſolidation of the bone only ceaſes for a time, as we mentioned to have been ſometimes obſerved in women with child, the cure muſt then be deferred till they are delivered. But whether or no the method which Celſus [m] propoſes, may be of ſervice in the like caſes, ſeems a matter of doubt; for he ſays, *Si quando vero oſſa non conſerbuerunt, quia ſæpe ſoluta, ſæpe mota ſunt, in aperto deinde curatio eſt. Poſſunt enim coire. Si vetuſtas occupavit, membrum extendendum eſt, ut aliquid lædatur: oſſa inter ſe manu dividenda, ut concurrendo exaſperentur, et, ſi quid pingue eſt, eradatur, totumque id quaſi recens fiat. Magna tamen cura habita, ne nervi muſculive lædantur:* "But if the bones do not firmly "conſolidate, either becauſe they have been fre-"quently ſeparated or agitated, even then the cure "is not difficult; for they may unite. If the caſe is "of long ſtanding, the limb is to be extended, to "make ſome injury: the bones are to be divided by "the hand, and made rough by rubbing them a-"gainſt each other, that if any fat interpoſes it may "be rubbed off, and the whole be rendered as if it "was a new fracture. But great care is to be taken "not to injure any of the nerves or muſcles." His whole deſign ſeems to conſiſt in making a freſh wound of the bones, by rubbing them againſt each other; but if any ſplinters are thus broke off, they may occaſion much miſchief. It may perhaps be bet-

[m] Lib. VIII. cap. 10. pag. 541.

ter

ter to commit ſuch a caſe to nature only, who is often obſerved to operate wonderfully for the patient's benefit. A man had a tranſverſe fracture of both bones of the cubitus, at the diſtance of four fingers breadth from the carpus: he would neither ſuffer the bones to be replaced, nor any bandage to be applied, for fear of the pain, nor yet would he ſuffer the limb to be at reſt, which prevented the conſolidation of the fragments, and formed (in a manner) a new joint in the fractured part, with which he afterwards ſurvived without any conſiderable pain or inconvenience. After his death, one of the ſurgeons who had ſeen the fracture, diſſected the arm, and found that the ends of the upper fragment had acquired a round figure, which correſponded to cavities of the like ſhape in the ends of the lower fragments. The perioſteum was grown thicker round the divided parts of the bone, and formed as it were a ligament to confine and ſtrengthen the new articulation. Even the cavities formed in lower fragments were much depreſſed before, and much more elevated behind; ſo as eaſily to permit a flexure of the joint forwards, and prevent too great an extenſion of it backwards, almoſt in the ſame manner as in the joint of the elbow. Theſe bones, we are told [n], were preſerved by the celebrated du Verney, among his anatomical rarities.

Sometimes the growing callus is obſerved to riſe above the equal ſurfaces of the bones, eſpecially in younger patients, who have their ſolids moſt ſoft and lax, and their juices more redundant; and this happens much in the ſame manner as proud fleſh is formed by a luxuriancy of the veſſels leſs preſſed in wounds of the ſoft parts. This more eſpecially happens when the repullulating and as yet ſoft veſſels are too much diſtended by the juices, too impetuouſly moved in a fever; for the juices are ſometimes ſent to the parts

[n] Nouvelles de la Republique des Lettres l'an 1685. pag. 118, &c. & in Actis Erudit. menſe Novemb. 1685. pag. 513, &c.

ſo

ſo abundantly, that Galen[o] ſays, he has often ſeen the bloody juice poured out under the entire ſkin, that inveſts the fracture, ſo as to fill out the bandages. In ſuch a caſe, it will be convenient to uſe ſuch remedies as diminiſh the quantity of the juices, and abate their force, or drive them from the injured part. Therefore bleeding, and ſuch purges as act without inflaming, will be here ſerviceable, joined with a ſpare diet, ſufficient to ſupport life without augmenting the quantity of the juices. A gentle friction of the parts will likewiſe be of ſervice to carry off the too great redundancy of the juices there accumulated; to which add a more ſtrict compreſſure, that the too lax veſſels may be better ſecured to reſiſt the impulſe of the diſtending humours. All which are very well obſerved by Celſus[p], for if the callus grows out too much, ſo as to form a tumour in the place, he ſays: *Diu leniterque id membrum perfricandum eſt ex oleo et ſale et nitro, multumque aqua calida falſa fovendum, et imponendum malagma, quod digerat, adſtrictiuſque alligandum: oleribuſque, et præterea vomitu utendum, per quæ cum carne callus quoque extenuatur: confertque aliquid de ſinapi cum ficu in alterum pariter membrum impoſitum, donec id paululum erodat, eoque evocet materiam. Ubi his tumor extenuatus eſt, ruurſus ad ordinem vitæ revertendum eſt:* "That limb is to be gently "rubbed for a conſiderable time, with a mixture of "oil. ſalt and nitre, and to be well fomented with "hot ſalt water, after which a diſcutient cataplaſm is "to be applied, and the bandages drawn tighter; "laxative pot-herbs, and alſo a vomit, are to be "uſed, which both diminiſh the fleſh and callus: it "will be alſo of ſome uſe to apply a fig and muſtard "to the oppoſite limb, and let it remain till it has "bliſtered a little, and by that it may cauſe a revul-"ſion of the matter. When the ſwelling is extenuated

[o] Commentario 3. in Hippocrat. de Articulis. Charter. Tom. XII. pag. 394.
[p] Lib. VIII. cap. X. in fine. pag. 542.

"by

" by theſe means, the patient may then return to " his ordinary courſe of life." But if the ſuperincumbent weight of the body ſhall have forced out the callus from betwixt the bones in the form of a ring, by an imprudent uſe of the limb too early; in that caſe the limb ought to be extended again to its due length, and the exorbitant callus forced within its due bounds by an external preſſure.

But when a deficiency of the callus is feared either from too great a compreſſure of the part, or from any other cauſe; then a looſer application of the bandages, with emollient fomentations, and a more full diet, joined with ſuch medicines as excite the languid motion of the juices, will be found more particularly uſeful. For this purpoſe, namely, to procure a more ſucceſsful reproduction of the callus, Hippocrates[q] directs, that if the limb is unbound after the ſplints have been uſed, it ought to be fomented, and afterwards bound up more gently, and with fewer bandages than at firſt. And Galen[r] in his commentaries on this place obſerves, that Hippocrates on the firſt day increaſed his number of bandages, and applied them more ſtrictly, till he came to the ſplints; but after the ſeventh day, laying aſide the ſplints and the reſt of the apparatus, he ſuffered the part to remain at reſt until the twentieth day, for the nutrition of the callus; and then he derived the matter of the callus to the part, by pouring on warm water, whereas in the beginning he increaſed the number and ſtricture of his bandages, to prevent the afflux of the ſame matter thither. This is well expreſſed by Ægineta[s], when he ſays: *Quædam fracturæ ſine callo manent, ultra definitum naturæ limitem; vel ob continuas reſolutiones, vel ob immoderatas fomentationes, vel ob importunum motum, vel ob multitudinem faſciarum, vel ob totius corporis atrophiam; a quibus et tenuius membrum fieri*

[q] De Fracturis textu 43. Charter. Tom. XII. pag. 180.
[r] Ibidem. pag. 181.
[s] Lib. VI. Capit. 110. pag. 101.

accidit.

accidit. Oportet igitur et alias occaſiones cum ſtudio removere, maxime autem atrophiam: partim calidioribus alimentis materiam attrahentes ad partem, uti et nutrimentum ſufficiens et balnea et eliquam animi hilaritatem ſubminiſtrantes. Signa vero callo jam firmatorum ſunt, et alia quidem, maxime vero faſcias madeſcere, nullo etiam vulnere oborto, &c. "Some fractures remain without a callus, beyond the time allotted by nature for its formation; either becauſe of the frequent undreſſings, an immoderate uſe of fomentations, unſeaſonable motion, a multitude of bandages, or even from an atrophe of the whole body; from whence alſo the limb ſhrinks or becomes leſs. Theſe and other impediments ought therefore to be ſtudiouſly removed, but more eſpecially the atrophe; partly by more warm or ſpicy aliments, and things which derive the juices to the part, with a ſufficient quantity of nouriſhment and the warm bath, with whatever elſe tends to render the mind chearful. But the ſigns that the bones are grown firm by a callus, are, among others, principally a moiſtening of the bandages, when there is no wound made, *&c.*" As for what is to be thought of the lapis oſteocolla and other ſuch remedies, to promote a callus, we have already declared in the comment on § 347. numb. 3.

But the callus with which the fractured bones are conjoined, at length puts on the nature and firmneſs of a bone; inſomuch that we are aſſured from obſervations, that the bone will afterwards break rather in any other part than in the callus, or remains of the old fracture. Yet Ruyſch tells us[t], that he found the bones of a hen, which had been broke and conjoined by nature in ſuch a manner, that only the ſpongy ſubſtance of the bone was regenerated, without the hard external lamella, which by its firmneſs naturally defends and ſecures the former. But it is evident, that bones thus conjoined may very eaſily be

[t] Theſaur. Anatomic. 8. n°. 49.

broke

broke again, and that this caſe ſometimes happens in human bones he is apt to believe, becauſe they are ſometimes broke again by the ſlighteſt cauſes.

There is yet another remarkable obſervation in the ſame author[u], by which it appears, that the ſevereſt pains and ſymptoms may ſupervene in a fracture, though all proper care has been taken. For he kept by him two thigh bones, which had been ſo ill managed after a fracture, that the fragments rid over each other; and what was more remarkable, he found various ſpines or exoſtoſes, many of which being ſharp and ſlender might wound the adjacent parts; and theſe ſpines were not only found about the circumference of the callus of the fracture, but they alſo aroſe from the ſound part of the bone above the fracture, and he perceived ſome of them ariſe out of thoſe ſmall holes into which the tendinous fibres are uſually inſerted, which fibres being tore off from the bone in a fracture or a luxation, he believed might occaſion the like ſpines or exoſtoſes. This opinion of his we find more largely confirmed by ſimilar obſervations on the bones of other animals, which he there relates. And although it may not be eaſy to foreſee or prevent the like accidents, yet it is thence evident, that we ought not raſhly to impute thoſe conſequences to the ſurgeon, (who may be often one of the beſt merit) which no art or induſtry can prevent, and which may attend a fracture that has been moſt exquiſitely treated.

[u] In Muſæo Anatomico ſive Catalogo rariorum, &c. Theca A. Repoſitor. V. n°. 1 & 2. pag. 129, 130.

Of Luxations.

SECT. CCCLVIII.

A Luxation is the receding of the head of ſome moveable bone out of the cavity in which it naturally turned, accompanied with an impediment or loſs of its motion.

A luxation, called alſo a [a] diſlocation, is the diſplacing of a bone from its natural ſeat; and in this ſenſe it denotes any kind of change in the natural ſite of the bones. But from uſe, which principally determines the ſignification of words, this term has been reſtrained to ſignify only the diſplacing of bones from their articulations, where they naturally reſided. But Celſus[b], in treating on luxations, makes a twofold diſtinction of it, when he ſays: *Moventur autem ea ſedibus ſuis duobus modis. Nam modo, quæ juncta ſunt, inter ſe debiſcunt: ut cum latum os ſcapularum ab humero recedit, et in brachio radius à cubito, et in crure tibia à ſura; et, interdum ſaltu, calcis os à talo; quod raro tamen fit: modo articuli ſuis ſedibus excidunt:* "But the bones are moved out of their places two "ways. For ſome bones that are joined together are "ſo diſplaced, that there is a ſpace left betwixt "them: as when the broad ſcapula recedes from the "humerus, and the radius from the ulna in the cubi-"tus, and the tibia from the fibula in the leg; and "ſometimes in leaping, though but rarely, the cal-"caneum from the aſtragalus: in the other way the "heads of the bones are removed out of their places."

[a] Cael. Aurelian. Morb. Chronicor. Lib. II. cap. 1. pag. 347.
[b] Lib. VIII. cap. 11. pag. 542.

Since

Since therefore a luxation, properly ſpeaking, takes place only in the articulated or moveable bones, the definition above given is a very proper one. For in every articulation there are two bones to be conſidered, that which receives, and the other which is received. The concavity in the receiving bone, which takes in the head of the other bone, is, by the ancients, termed κοτύλην; and the projecting part of the other bone, which is received into that cavity, is termed ἄρθρον, or ſimply the [c] joint. Hence we have an excellent definition of a luxation given us by Ægineta [d]; namely, that it is *elapſus articuli ex proprio cavo in alienum, à quo motus arbitrarius impeditur:* "the ſlipping out of the head of a bone from its "proper cavity, into ſome improper place, whence "the voluntary motion thereof is obſtructed:" for if the motion is not obſtructed at the ſame time, it cannot be properly called a luxation, even though the head of the moveable bone is out of its cavity in which it naturally moves. For in the wonderful articulation of the lower jaw, the round heads of that bone are indeed placed in cavities deep enough, fixed at the bottom of the oſſa ſquamoſa, whence the proceſſus zygomaticus ariſes, and yet by means of a cartilaginous elaſtic plate interpoſed between the heads of the lower jaw, they are allowed to go out of their ſinuſes, and return into them again without any injury of their motion. It was even neceſſary that this articulation ſhould admit of this motion, for the lower jaw to perform its ſeveral actions in all manner of directions.

SECT. CCCLIX.

WHICH may be done either wholly or but in part; whence we have a luxation and a diſtortion.

[c] Gotræi Definit. ἄρθρον. pag. 77.
[d] Lib. VI. cap. 111. pag. 101.

It

It is eaſily conceived that the articulated head of a bone may either ſlip quite out of its natural cavity, or elſe be ſo diſplaced as to remain partly in and partly out of its ſaid cavity. Yet Hippocrates[a] denies that this can take place in all articulations: for he concludes, that as the head of the os humeri and os femoris are round, and are received into cavities of the like ſhape, they muſt of neceſſity either go quite out of their cavity, or if they go out but in part they muſt ſlip back again into thoſe cavities. But it is ſufficiently evident, that this may happen in the other joints. Ægineta[b], in his definition of luxations adds: *Differentias alias dicere non habemus, niſi ſolum illam quæ ſecundum majus et minus contingit. Omnino enim elapſo articulo communi generis nomine* ἐξάρθρημα *dicitur; leviter vero dimoto, vel uſque ad ſupercilia cavitatis prolapſo* παράρθημα; "We have no other differences "to mention, except that only which ariſes from "more or leſs: for the head of a bone ſlipt perfect-"ly out is called by the general term a luxation; "but being ſlightly diſplaced, or only ſlipt out to "the edge of the cavity, it is termed a ſubluxation." It was cuſtomary to prefix the prepoſition παρά, *ſub*, before words, to diminiſh their ſignification, or denote a ſlighter affection; whence ſome phyſicians ſay parapoplexia for a ſlighter kind of apoplexy, paracynanche for a ſlight quincy, *&c.* and therefore Veſalius[c] ſeems not to have uſed theſe words with proper exactneſs, when he ſays that luxations ariſing from a flux of humours into the articulation are termed παραρθρήματα; but thoſe from violence ἐξαρθρήματα. For it will appear from what follows, that a true or perfect luxation may ariſe from a flux of humours into the cavity of the joint. But it is uſual to call that ſpecies in which it is but partially diſplaced, a ſubluxation or diſtortion. And yet the term diſtortion alſo ſignifies commonly the diſplacing of muſcles or

[a] De Articulis Charter. Tom. XII. pag. 427. [b] Lib. VI. cap. 111. pag. 101. [c] Chirurg. magn. pag. 921.

tendons

tendons by ſome external violence; as it alſo ſignifies a diſtraction and twiſting of the ligaments from the ſame cauſe. Therefore ſuch an imperfect or partial luxation is with leſs ambiguity termed a ſubluxation.

SECT. CCCLX.

THE worſt ſpecies of which diſorder is, when the epiphyſis or head of a bone happens to ſeparate from its diaphyſis or body.

In the larger bones which are joined to others by ſome moveable articulation, it is obſervable, that each end is diſtinct from the reſt, or body of the bone; which is moſt conſpicuous in the bones of abortive and new born infants. For theſe bones themſelves were once wholly cartilaginous, and in the middle of their length, a ſmall round grain of bone firſt began to appear, which ſoon ſpreading itſelf each way longitudinally, changes the cartilage into bone[a]. But both extremities of the bone remain a long time cartilaginous, and in the middle of theſe likewiſe the cartilage begins to change into bone, which by degrees ſpreads itſelf throughout the whole maſs of the cartilage. But for a long time after there remains ſomething of a cartilage betwixt the body and end of the bone, as, for example, in the thigh bone; by which cartilage the end ſeems in a manner to be glued to the body of the bone, till at length this cartilage alſo oſſifies, and cauſes the extremities and body to grow into one continued bone[b]; ſo, however, as to leave ſome mark or diviſion externally for a conſiderable time, till at laſt that mark or line is alſo obliterated[c]. Theſe extremities of the bones, as of the os femoris, diſtinguiſhed by an intermediate cartilage,

[a] Albini Icones Oſſium fœtus humani, &c. pag. 101. [b] Ibid. pag. 156. [c] Ibid. pag. 102.

or a line from the body of the bone, are called its epiphyſes; and in younger animals, theſe epiphyſes are ſeparable by a ſmall force from the body of the bone, as is daily obſerved in the firſt months. But the ligaments which every way inveſt and ſecure the articulations, grow out from thoſe places where the epiphyſes join with the body of the bone; and therefore Columbus [d] would have this to be the principal uſe of the epiphyſes; namely, that the ligaments, which are continued to no other part, might ariſe from their conjunction in thoſe places with the bones. And Havers [e] has alſo obſerved, (as we ſaid in the comment on § 343.) that in thoſe places whence the ligaments ariſe, the perioſteum, which hitherto covered the whole ſurface of the bone, there departs from it, and climbing over the ligaments which there ariſe, it proceeds to the next bone.

If therefore the epiphyſis is ſeparated from the body of the bone, it will evidently diſturb the motion of the joint. But yet it does not ſeem ſo proper to call it a luxation, becauſe the end of the moveable bone continues in its cavity, in which it naturally moves; but in the definition given at § 358. it is the receding of the head of the bone from its cavity which conſtitutes a luxation: whence this diſorder might perhaps have been better referred to fractures. Galen [f] ſeems to reckon it among the ſpecies of fractures, calling it ἄπαγμα, whereas he comprehends the other fractures under the general name κατάλματος: and he obſerves that the word ἄπαγαμα is peculiar to phyſicians, being diſuſed by moſt other people; but that it ſignified that ſpecies of fracture, in which the articulating head of the bone is broke off: But as this kind of fracture is often taken for a luxation, therefore it is uſually referred hither. But this accident more eſpecially happens in luxations of the femur,

[d] De re Anatomica, lib. I. cap. 2. pag. 5. [e] Oſteolog. pag. 17, 18. [f] Method Med. Lib. VI. cap. V. Charter. Tom. X. pag. 143.

as

as they are called, but which are very frequently a ſeparation of the epiphyſis from the body of the bone, or elſe a fracture in the neck of the femur itſelf, which is there very ſmall. For Ruyſch[a] tells us, that a celebrated ſurgeon opened the bodies of eight lame old women, and always found the neck of the femur had been fractured, but never luxated. But ſince in young infants the epiphyſes of the bones are more eaſily ſeparable by a leſs force, therefore this injury more frequently happens to them; eſpecially if an infant ſuddenly throws its body backward while it is carried in the arms; for then there is great danger of ſeparating the epiphyſes of the femur, or of breaking the neck itſelf of that bone, which occaſions them to be lame afterwards during life, while the body of the bone, being ſeparated from its head, is contracted upwards by the muſcles. But wonderful efforts of nature have been often obſerved, in order to relieve this injury: for Ruyſch found, in the body of an old woman who had this diſorder, that the neck of the femur was quite abſent, and that nature had ſubſtituted various hard, thick, and round ligaments in its place, by means of which the round head of the femur was connected to the reſt of the bone[b]. It is eaſily apparent, that the difficulty is much greater in the cure of this diſorder, than in a luxation properly ſo called; for a luxated bone being reduced in its natural ſeat, is eaſily retained there, provided the limb is at reſt: but when the epiphyſes is ſeparated from the body of the bone, the muſcles inſerted into the bone do by their natural contraction draw it from thence; whence a ſhortening of the limb, and a defect in its motion almoſt conſtantly follows.

[a] Ruyſch Theſaur. Anatom. VIII. n. 103.
[b] Idem Theſauro IX. n. 74.

SECT. CCCLXI.

THE cauſe of which is ſome extending, diſtorting, or expulſive force acting externally.

No luxation can follow without ſome external force, if the inveſting and articulating ligaments are in their natural ſtate: even a very great force is required to disjoint the bones in adult and ſtrong people; as is very evident from the ſtrength of the inveſting ligaments of the joints. But any force externally applied will act in one of the three ways mentioned in this aphoriſm.

SECT. CCCXLII.

OR ſome internal cauſe, formed in the cavity of the joint, and thruſting out the head of the bone.

The ligaments which connect the articulated bones ariſing from thoſe places where the epiphyſes are conjoined to the reſt of the bone, inveſt the whole articulation in the manner of a capſule or bag, ſo as to form a cavity cloſed on all ſides; nor can they permit any thing to enter from without, nor ſuffer any thing to eſcape from within. In this cavity of every articulation are contained the two ends of the receiving and received bone, incruſted on all ſides with a cartilage; and in the larger articulations, furniſhed with conſiderable glands, denominated from Havers, their firſt diſcoverer. One large gland of this kind is ſeated in the articulation of the femur, and four or five ſmaller are viſible in the articulation of the knee*. Beſides theſe, there are many ſmaller follicles or

* Clopton Haverſ. Oſteolog. pag. 190—201.

drains

drains in the ſurface of the ligament which inveſts each articulation. Theſe glands, which by anatomical injections appear to conſiſt of innumerable ſmall veſſels, ſerve to ſeparate and furniſh a mucus, like the white of an egg [b], and of a brackiſh taſte. But the cartilaginous ends of the bones contained in the cavity of the articulation, not being covered with any perichondrium, ſeem to tranſude a thin medullary oil, which is lodged in conſiderable quantities in the cavernous parts of the bones, near their articulations. In the larger bones of a horſe, Dr. Havers [c] could perceive theſe pores with his naked eye, through which the medullary oil tranſuded into the cavity of the articulation; and the ſame thing is confirmed by many other experiments. For when the joints of a dead body are preſerved entire until all the mucilage is gradually conſumed, or perhaps abſorbed, a mere oil is found in their cavities, which the ſame author has alſo obſerved in the joints of the fingers [d]. Animals that are killed, after long and violent exerciſe, have very little medulla in the cavities of the larger bones; whereas in well fed and idle animals the medulla abounds. From all which it ſeems to be ſufficiently evident, that the medulla of the bones, tranſuding their extremities, mixes with the mucilage ſeparated by the glands; ſo that from a mixture of theſe two is formed that liniment with which the extremities of the articulated bones are anointed and lubricated, that they may ſlide eaſily upon each other without much attrition. And for this reaſon when the fat or oil is wanting, or conſumed by too much labour, old age, or diſeaſes, a grating or crackling of the joints is perceptible, from the attrition of the too dry ends of the bones againſt each other. Add to this alſo, that the thin dew or vapour is likewiſe diſcharged from the ſmalleſt exhaling arteries into the cavities of the joints, as well as into all the other cavities of the

[b] Clopton Haverſ. Oſteolog. pag. 200, 206. [c] Ibid. pag. 173. [d] Ibid. pag. 372.

body, whether large or ſmall, with which we are as yet unacquainted.

There is therefore a threefold humour meets in the cavities of the joints; namely the univerſally perſpiring vapours, the medullary oil, and the mucilage ſeparated by the glands there ſeated; from all which mixed together, ariſes that lubricating liniment, which being attenuated by the warmth and mutual attrition of the bones, is returned or abſorbed in the ſame quantity in which it was ſent into the joint: but if the abſorption or return of this liniment is from any cauſe impeded or diminiſhed, while the ſecerning and expulſive cauſes continue, the liniment will be then accumulated ſo as to diſtend and weaken the ligamentary capſule of the joint; whence the prolapſion of the articulated head of the bone from its proper cavity may eaſily ariſe from this cauſe. That tumours of a conſiderable magnitude often ariſe about the joints from this cauſe, is teſtified by innumerable practical obſervations. And Havers[e] demonſtrates, that the medullary oil which tranſudes through the cartilaginous ends of the bones into the cavity of the articulation, is very apt to concrete or ſtiffen, if not duly attenuated by the motion and attrition of the bones againſt each other. For he tells us, he has often obſerved this oil ſtagnant and concreted in the pores through which it uſually tranſudes) in ſuch animals as have been fattened without uſing exerciſe; and that at the firſt view he imagined the ſame to be ſmall glands, but he afterwards found them to be nothing more than a concreted oil.

This cauſe of luxations, with many more particulars relating to this diſorder, we meet with in Hippocrates[f]; for in treating on the articulations, he ſays, *Mucus omnibus natura ineſt, et quum purus fuerit, ſani ſunt articuli, ideoque facile moventur, utpote lubrici inter ſe. Labor autem et dolor oritur, quando a*

[e] Clopton Haverſ, Oſteolog. pag. 174 [f] De Locis in homine cap. 3. Charter. Tom. VII. pag. 361.

carne

carne laborante fluit humor. Imprimis quidem rigeſcit articulus, non enim lubrica eſt humiditas ex carne affluens. Deinde utpote copioſa et valde diſperſa, neque ex carne irrigata, ſemper reſiccatur quumque illam ob multitudinem articulus capere non poſſit, effluit, maleque concreſcens nervos, quibus articulus colligatur, attolit, relaxat et diſſolvit: et ob illud claudi fiunt magis minuſve, prout illud magis minuſve fit: "That all of them "are naturally ſupplied with a mucus, which when "pure, or of a healthy conſiſtence, the articulations "are ſound, and therefore eaſily moveable, as being "ſlippery upon each other. But pain and a difficult "motion ariſes in the joint, when the juices flow to "it in too great a quantity from a bad habit of body; "for their moiſture diſtilled from the veſſels or fleſh "is not lubricating, and therefore the articulation "will more eſpecially become ſtiff. On the other "hand, the articulation will alſo become ſtiff or dry, "when the mucus is too abundantly and powerfully "diſſipated, and not ſupplied again from the ſoft "parts; and when the dried mucus is ſo redundant, "that it cannot be confined within the articulation, it "then eſcapes, and cauſes a bad concretion or rigidity "of the ligaments which connect the joint which is "thus diſtorted, relaxed or diſlocated: and from "hence the patient becomes lame more or leſs, ac-"cording to the degree of the diſorder." And, in another place [g], *Quibus ab iſchiade diuturna vexatis iſchium excidit, et rurſus incidit, illis muci innaſcuntur*; "In thoſe who have the head of the femur ſlip in "and out, after being long afflicted with ſciatica, "there is an accumulation of the mucus."

If now we alſo conſider that inflammation may ariſe in theſe parts, ſince the ligaments and glands of the articulations appear, from anatomy, to be furniſhed with innumerable arteries; from hence therefore a ſuppuration may follow, with an accumulation of the formed matter within the cavity of the articulation,

[g] Sect. VI. Aphor. n. 59. Charter. Tom. IX. pag. 289.

&c. and by theſe means may be produced all thoſe ſymptoms which ariſe from a collection of the mucilage of the joints from not being abſorbed or returned again into the blood. That luxations very frequently ariſe from this cauſe, we are aſſured by M. Petit[h], who ingenuouſly confeſſes that he learned this from his own errors. For when by a fall, or other accident, the trochanter major is urg'd upwards, it is evident that the head of the femur will be very forcibly preſſed into the acetabulum or cavity in which it moves; whence the glands and round ligament there ſeated may ſuffer a violent contuſion, which we know is often followed with an inflammation, ſuppuration, and accumulation, either of matter or mucilage within the joint. The ligaments being thus diſtracted and weakened, will be no longer able to retain the head of the femur in its ſituation, and the muſcles inſerted in the trochanters drawing the femur upward, will force out the head of that bone from its acetabulum, which will occaſion an incurable lameneſs afterwards. 'Tis hard to diſcover this diſorder at firſt, as the luxation follows not for a long time. If we know that ſuch a contuſion in the joint has preceded, and there remains a troubleſome pain in the articulation, then bleeding, with a thin diet and cooling medicines are required, to prevent the inflammation, or remove it when preſent. It will be alſo very ſerviceable to keep the part at reſt, and apply convenient fomentations; and thus may a luxation be prevented, when it is about to follow from this cauſe; and which being once formed, ſeems to be incurable.

[h] Academ. des Sciences, l'an. 1722. Mem. pag. 159, &c.

SECT.

SECT. CCCLXIII.

THESE luxating cauſes (361, 362.) are aſſiſted by every thing which extends, relaxes, or breaks the ligaments, whether the cauſe from whence they ariſe be external or internal.

'Tis the coheſion of the ligaments only which retains the articulated bones in their proper ſituations; which ligaments are required to be flexible, that they may give way to the various motions of the joints; and at the ſame time they are required to be ſo firm, as not eaſily to ſuffer too great elongation. It was before demonſtrated, in the commentary on § 25. numb. 3. that too great a diſtraction is juſtly enumerated among thoſe cauſes which weaken the ſolid parts of the body; whence too great an extenſion of the ligaments may diſpoſe the joints to be eaſily luxated afterwards, tho' it does not immediately produce the luxation. The ſame is alſo true, if the ligaments do not ſufficiently reſiſt the diſtending cauſes, either through ſome weakneſs in themſelves, or from a general relaxation of the whole habit. Therefore Celſus [a], in deſcribing the general cauſes of luxations, ſays: *Omnes articuli, cum validis nervis comprehendantur, excidunt aut vi expulſi, aut aliquo caſu nervis vel ruptis, vel infirmatis; faciliuſque in pueris et adoleſcentulis, quam in robuſtioribus*; "Since all the articulations are inveſted with ſtrong ligaments, they are diſplaced either by ſome expulſive force, or from a weakneſs or rupture of the ligaments by ſome accident; whence they more eaſily happen in children and young people, than in thoſe who are ſtrong." It is univerſally well known, that the ſolid parts are weaker and ſofter, or more eaſily diſtracted in young ſubjects; tho' there are even ſome adult, and otherwiſe ſtrong people, who are found to

[a] Lib. VIII. cap. 11. pag. 543.

have

have a great laxity of almoſt all the ligaments of their joints; and there are often tumblers, or poſture-maſters, that expoſe themſelves for a public ſhew, who by the action of their muſcles only, can luxate almoſt all their joints, and again replace them by the ſame means, ſo as to make their bodies turn almoſt into any ſhape, like a piece of wax. Hence Hippocrates [b] juſtly obſerves, *Quod in luxatis facile reſtituendis multum naturæ à naturis differant, et multum cavum a cavo diſtet: nam hoc quidem facilius, illud difficulter ſuperatur. Multum etiam differt nervorum colligatio, quibuſdam laxa, quibuſdam tenſa, etc. Complures autem videre licet, qui ita humidi ſunt, ut, ubi velint, ſine dolore articulos ſuo loco moveant, et ſine dolore reſtituant*; "That there is a great deal of difference in "luxations, as to their being more or leſs eaſily re-"duced, according to the different nature of the "joints, the cavity of one being much deeper than "that of another; ſo that the bone will more eaſily "ſlip out of one than the other. There is alſo a "great deal of difference in their connection by the "ligaments, ſome of which are lax, and others tenſe, "*etc.* And we meet with ſeveral who have their "joints ſo moiſt, that they can diſplace them, and "reſtore them again when they pleaſe, and that with-"out any pain." He afterwards adds, that fleſhy joints do not ſlip out ſo eaſily; but then they are more difficultly replaced, when out; whereas in lean people they are more eaſily replaced. He then confirms his diſcourſe by the inſtance of oxen, which being emaciated towards the end of the winter, do very eaſily ſuffer a luxation of the femur.

But if the ligaments have been broke by any external violence, or if their continuity has been diſſolved by any ſuppuration, eroſion, *etc.* it is very evident that then a ſlight force may luxate the joint.

[b] De Articulis, Textu 23, etc. Charter. Tom. XII. pag. 304. etc.

SECT.

SECT. CCCLXIV.

HENCE follow an alteration of the figure of the limb, with a tumour, excavation, a ſhortening or an elongation thereof; a diſtraction, immobility, and numbneſs, or palſy of the muſcles below the joint; a compreſſure of the adjacent veſſels, followed with pain, watchings, inflammation, and œdema, anchyloſis, convulſion, a withering, and death, either of the part or of the whole body.

This aphoriſm comprehends thoſe ſymptoms which uſually accompany or follow after luxations.

An alteration of the figure, a tumour, or excavation.] Celſus [a], in deſcribing the ſigns which accompany every luxation, ſays, *Siquidem ſemper ea parte tumor eſt, in quam os prorumpit; ea ſinus, à qua receſſit*; "That there is indeed always a tumour in that "part to which the bone is thruſt; and a ſinus or "cavity in the part from whence it receded." But ſuch an unuſual tumour and preternatural excavation more eſpecially appear when the diſlocated joint is not much loaded with fleſh, as in the ſhoulder and elbow: for in the thigh it is very difficultly diſcerned, becauſe of the many muſcles and circumjacent fat which inveſt the articulation. But in order to determine with certainty whether or no the joint is diſlocated, Hippocrates [b] wiſely directs to compare the injured limb with that which is ſound: *Ad exemplum enim integri æſtimare vitiatum oportet, neque ſpectare alterius hominis articulos, (quibuſdam enim hominibus magis prominent articuli, quam aliis) ſed ipſius laborantis, an integer vitiato diſſimilis ſit*; "For the figure of the "injured limb ought to be compared with that of a

[a] Lib. VIII. cap. 11. pag. 543. [b] Hippocrat. de Articulis, Textu 34, etc. Charter. Tom. XII. pag. 310.

"ſound

" found one; and this not by inſpecting the joint " of another perſon, (for in ſome people the joints " are more protuberant than in others,) but by ob- " ſerving whether the ſound limb differs from that " which is injured in the patient himſelf." But an alternation of the figure alone is not ſufficient to demonſtrate that any joint is diſlocated, for as Hippocrates [c] likewiſe obſerves; *Multi enim articuli præ dolore, aut alia de cauſa, licet ipſis non exciderint, nequeunt tamen eo modo, quo in ſanis corporibus, figurari*; " Many joints, through pain or ſome other accident, " are prevented from reſembling the figure of the " ſame joints in healthy bodies, even though they " are not diſlocated." Even though a preternatural excavation ſhould appear in the place of the articulation, unleſs an uſual tumour alſo appears in another part where the head of the bone is thruſt, a perſon may be egregiouſly deceived, eſpecially in the joint of the ſhoulder. Hippocrates [d] even ſays, that he knew ſeveral phyſicians of note, who believed the humerus was luxated, when they ſaw a cavity upon the ſhoulder from the depreſſion of the head of the humerus below the acromion: and Galen [e], in his commentary on this text of Hippocrates, relates that he had met with the ſame accident in himſelf. For when he was in the field of exerciſe, the maſter of the field perceiving a preternatural cavity in his ſhoulder from the raiſing of the acromion, imagined that the head of the humerus was prolapſed into the axilla, which occaſioned him to extend Galen's arm, and to make a needleſs attempt to replace the bone: but this being done with a violent extenſion made by ſeveral aſſiſtants, Galen himſelf endeavoured with the fingers of his other hand to reduce the head of the humerus, but Galen finding no preternatural protuberance in the axilla, adviſed them to forbear making

[c] Hippocrat. de Articulis, Textu 34, &c. Charter. Tom. XII. pag. 311. [d] Ibid. Textu 62. pag. 321.
[e] Ibid. pag. 322, 323.

any

any farther extenſion; but they notwithſtanding continued their extenſion, imagining that Galen requeſted them to forbear by reaſon of the pain; and if one more prudent than the reſt had not come to his aſſiſtance, they would have pulled off the muſcle. But by this perverſe treatment, Galen perceived that a convulſion was beginning to invade his arm, and which he could not keep off, but by the continual pouring in of warm oil; as we mentioned once before upon another occaſion in the commentary on § 164. From hence it is evident, how much caution is neceſſary in order to determine whether a joint is luxated, ſince the moſt ſkilful have been ſometimes miſtaken. Thus I ſaw an unhappy countryman, whoſe whole arm was invaded with a gangrene up to the ſhoulder, which being ſwelled with a true phlegmon, was by an ignorant fellow deemed and treated as a luxation of the cubitus, though by his ſtrong and repeated extenſions, he made the people imagine he excelled every body in the cure of fractures and luxations.

A ſhortening or elongation of the limb.] When the head of the bone is diſplaced from the cavity in which it ought naturally to move, then the muſcles, which are inſerted into that bone, do naturally contract and draw it upwards; whence it happens, that the diſlocated limb is generally ſhorter than the other, in the manner we deſcribed in the commentary on § 343. in treating on the ſhortening of a limb from a fracture of its bones. But in ſome caſes, though not often, the diſlocated limb is elongated; and this happens when the diſplaced head of the bone is ſo ſuſtained, that the muſcles cannot draw it upward. Thus for example, the lower jaw being luxated on both ſides, as Celſus[f] obſerves, *totum mentum inclinatur, et in exteriorem partem promovetur, inferioreſque dentes longius, quam ſuperiores excedunt, intentique temporum muſculi apparent*; "The whole chin will be

[f] Lib. VIII. cap. 12. pag. 544.

"inclined

" inclined downward, thruſt forward, the lower teeth " will come out much beyond the upper, and the " temporal muſcles will be found upon the ſtretch." For the heads of the lower jaw being prolapſed beyond the tubercles, which are placed before the cavities of its articulations, therefore they cannot be drawn back by the muſcles of the lower jaw, which will therefore project out beyond the upper jaw. And Hippocrates[s] treating on luxations of the femur, reckons it one of the ſigns which denote the femur to be luxated inwards, when the injured limb being compared with the other appears longer. For ſays he, *Oſſi enim, quod à coxa ſurſum procedit ad pectinem, femoris caput inhæret, et cervix articuli cavo ſuſtinetur.* The head of the femur is ſuſtained againſt " the bone, which is continued upwards from the iſ- " chion to the pubis, and the neck of the femur is " ſuſtained againſt the cavity of the articulation:" and for theſe two reaſons he judges the diſlocated limb is rendered longer than the other. A ſhortening of the limb will therefore happen the moſt frequently, and yet an elongation of it may likewiſe happenſome times: but the caſe is ſtill more rare for the luxated limb to be exactly of the ſame length with the ſound one; yet Hippocrates obſerves, that this may happen when the head of the femur is diſplaced forwards; though he alſo adds, that ſuch a luxation is ſeldom to be met with.

Immobility.] All thoſe motions, whoſe performance requires the diſplaced joint to be in its natural ſtate, can either not be performed at all, or at leaſt but with great difficulty: and it is certain that all the motions of a limb cannot be performed in a true luxation, as they were uſually performed when the limb was ſound. As for inſtance, in the articulation of the humerus in its natural ſtate, a perſon may deſcribe an infinite number of cones with his extended arm, the vertices of all which cones may be conceived to ter-

[s] De Articulis, Charter. Tom. XII. pag. 399.

minate

minate in the cavity of the articulation, while their baſes are deſcribed by the ends of the fingers: but if the head of the os humeri be diſplaced from its articulation with the ſcapula, thoſe motions cannot be performed. The ſame is alſo true of the other articulations. Yet all the motions of a joint are not continually deſtroyed by a luxation; for frequently ſome of the motions remain, as Hippocrates [h] well obſerves. For after having treated of ſuch as have their arms ſhorter from the day of their birth, either from a luxation in the uterus, or from ſome other cauſe, he ſays, *Quibus vero virili ætate humerus excidit, nec reſtitutus fuit, ſummus humerus attenuatur, et magis excarnis fit; ubi autem dolore liberantur, non æque præſtare poſſunt opera omnia, quæ requirunt, ut cubitus à pectore diductus in latera attollatur. Ad ea autem valent, quæcunque perficienda ſunt, humero vel in priorem partem, vel in poſteriorem, ad pectus adducto: nam terebra, ſerra, ſecure, etc. utuntur, dummodo cubitum non admodum alte attollere neceſſe ſit, etc.* "But in thoſe who "have a luxation of the humerus in their adult age, "without a reduction of it, the upper part of the "arm becomes very ſmall, and loſes much of its "fleſh; and even thoſe, who are free from pain, "cannot well perform all the motions required to "raiſe the arm, and move it from the breaſt to the "ſide. But any perſon is able to perform theſe mo"tions when the humerus is diſplaced either forwards "or backwards, being drawn towards the breaſt: for "theſe ſecurely uſe the ſaw, the terebra, &c. provi"ded it is not neceſſary to raiſe the arm up very "high." Hippocrates alſo points out in ſeveral places of the ſame book, treating of the different luxations, which of them deſtroy the motion of the joint, and in which of them the motions continue. So that under theſe reſtrictions an immobility of the limb is reckoned among the conſequences of luxations.

[h] De Articulis, Textu 61. Charter. Tom. XII. pag. 320.

A diſ-

A diſtraction of the muſcles.] The head of the diſplaced bone muſt neceſſarily preſs upon and diſtract the adjacent muſcles; and at the ſame time the ſituation of the muſcles inſerted into or attached to the bone will be altered; whence ſome of the muſcles will be ſhortened and others elongated. And on the ſame cauſe likewiſe depends the change of figure in the luxated limb. M. Petit [j], enumerating the ſigns which denote that the head of the femur is prolapſed backwards, obſerves that the gluti muſcles are relaxed, but that the triceps ſeems like a very tenſe chord extended from the region of the pubis to the middle of the os femoris. When each head of the lower jaw is luxated, it is evident from the anatomical ſtructure of the parts, how greatly the temporal muſcles will be diſtended, *etc.* whence often convulſions and death itſelf follow.

A ſtupidity or numbneſs of the ſubjacent parts, or a palſy.] Theſe happen when the prolapſed head of the bone compreſſes the large nerves adjacent; or as when the ſpinal medulla itſelf is compreſſed by a luxation of the vertebræ. Hippocrates [k], in treating on a luxation of the ſpine, obſerves, that when the upper part of the ſpine is diſlocated inwards, the whole body becomes ſtupid and relaxed (νεαρώμενοι) or paralytic. See what has been ſaid in the commentary on § 170. numb. 1. 7. If now the head of the os humeri ſlips into the cavity of the axilla, it will compreſs the large trunks of the nerves which are there ſeated, whence it is evident that theſe ſymptoms will invade the parts below. When the head of the os femoris is luxated forwards, among other ſigns of its being ſo luxated Hippocrates [l], reckons a ſuppreſſion of urine, becauſe then the head of the femur will be near the large nerves. But it would rather ſeem, that a compreſſion of the nerves ſhould produce an involuntary

[j] Academie des Sciences, l'n 1772. Mem. pag. 163.
[k] De Articulis, Charter. Tom. XII. pag. 390, 391.
[l] Ibid. pag. 422, 423.

luntary diſcharge inſtead of a ſuppreſſion of the urine. But Hippocrates[m] in another place takes notice, that if the ſpinal medulla is injured by any cauſe, at the firſt the patient neither voids the urine nor fœces; but when the diſorder becomes inveterate, he diſcharges them both without his inclination; from whence it appears, that a ſuppreſſion of urine may ſometimes follow a compreſſion of the nerves. If therefore the nerves deſtined to ſenſe and motion are entirely compreſſed, it will form a compleat palſy with inſenſibility; but if the compreſſion is only ſlight, it will impair and not totally aboliſh all the functions of the nerves; the ſubjacent parts will then ſuffer a torpidity, as Galen[n] well expreſſes it, being a diſorder betwixt a palſy and perfect health of the parts.

A compreſſure of the adjacent veſſels.] In the ſame manner as the head of the os humeri, prolapſed towards the axilla, often compreſſes the adjacent large nerves, ſo may it likewiſe compreſs the adjacent large blood-veſſels which are there ſeated; and thus it may impede the influx and reflux of the blood to and from the ſubjacent parts; whence may follow a gangrene or a withering. See what has been ſaid on this head in the commentary on § 161. and § 166.

Pain.] Such a diſpoſition of a nervous fibre ariſing from the brain, as threatens a rupture or ſolution of its continuity, excites the idea of pain in the mind, as we ſaid before in § 200. But a joint cannot be diſlocated without a violent diſtention of the ligaments inveſting the articulation; and ſo long as the bone remains diſplaced, ſo long will the ligaments be diſtended beyond their natural ſtate: from whence pain, and that in no ſmall degree, always accompanies every recent luxation; and which pain generally ceaſes, or at leaſt much abates, ſo ſoon as the bones are replaced. Hence therefore luxation is deſervedly

[m] Prorrhetic. Lib. II. cap. 11. Charter. Tom. VIII. pag. 819.
[n] De locis affectis, Lib. II. cap. 4. Charter. Tom. VII. pag. 404.

reckoned among the cauſes of pain § 224. numb. 3. If now we alſo conſider, that the perioſteum departs from the bones at their articulations, and continues on its courſe over the ligaments (ſee the commentary on § 343.) it will evidently appear, that the ligaments cannot be diſtracted without ſtraining the incumbent perioſteum in like manner, which being extremely ſenſible, may be another cauſe of pain. But when the diſlocated bone has not been replaced for ſome time, the ligamentary fibres are ſo weakened by the continual diſtraction (ſee § 25. numb. 3.) that they more eaſily yield or elongate without danger of breaking; whence the pain is gradually diminiſhed, and at length ceaſes. (ſee § 228. numb. 1.) But the circumjacent parts, which have been compreſſed and rubbed for ſo long a time by the diſlocated head of the bone, become at length callous and inſenſible: We obſerved before, in ſpeaking of the immobility which follows luxations, that thoſe are at length freed from their pain who have not had the diſlocated bones reduced, and that they can alſo perform various motions of the joint eaſily enough. And Hippocrates[o], in treating on a luxation of the femur outwards, ſays, *Ubi caro, in quam articulus exceſſit, jam trita eſt, et tenax evaſit, dolor tempore ceſſat. Quandō autem dolore liberi ſunt, ingredi ſine baculo poſſunt, ſi alioquin velint, poteſtque affecto crure ferri corpus*; "The "fleſhy parts, into which the head of the bone has "receded, become at length tough or callous by the "attrition, and the pain in time ceaſes. But when "the patients are free from pain, they are capable "of walking without a ſtick, if they ſo pleaſe, and "the weight of the body may be ſuſtained by the "affected thigh." For as Gorræus[p] obſerves, the word γλισχρον, *tenax*, denotes in the ſolid parts a toughneſs or calloſity; but in the fluids, a lentor or viſcidity.

[o] De Articulis, Charter. Tom. XII. pag. 411.
[p] Definit. Med. pag. 133.

Watch-

Watchings.] In the commentary on § 226. we reckoned *vigelia* or watchings among the effects of pain; and as it was before proved, that pain accompanies a luxation, it is evident that watchings ought to attend likewiſe, ſo long as the intenſity of the pain continues.

Inflammation.] It will appear in the ſubſequent diſſertation, that an inflammation attends whenever the impervious juices ſtagnate in the ſmaller veſſels, and are urged on behind by the increaſed force of the circulation in a fever, by which the juices are preſſed and ground together. Obſtruction therefore ſuppoſes a quicker circulation of the humours. But in the commentary on § 112. it was demonſtrated, that any force, which compreſſes or elongates the flexible veſſels, diminiſhes their capacity, and may therefore be the cauſe of obſtruction. But in a luxation the ligaments, tendons, and muſcles, attached to the bones, are elongated: the diſlocated bones compreſs the adjacent ſoft parts, and from both theſe an obſtruction may follow as the effect of a luxation. But a fever is reckoned among the effects of pain, (on § 226.) from whence it is evident that thoſe two cauſes attend in luxations, which are ſufficient to produce inflammation; namely obſtruction, and a ſwifter motion of the blood ariſing from the fever and pain which accompany every luxation. But how violent the fever and pains are, which follow from luxations, taught in ſeveral places by Hippocrates[a]; for, ſays he, *Humeri oſſe in cubiti articulo verſus pricrem partem luxato, niſi ſtatim reponatur, graves et vehementes inflammationes ſequuntur. Si vero verſus poſteriorem partem eruperit, maximum dolorem movet, et validiſſimas febres continuas, cum meracie bilis excretione, et paucis diebus lethales, excitat*; "The os humeri being luxated forwards at its articulation with the cubitus, is followed with moſt violent and intenſe inflammations, if

[a] Hippocrat. de fracturis, in fine libri. Charter. Tom. XII. pag. 266, 267.

" it is not immediately reduced; but when it is diſ-
" located backwards, it occaſions moſt ſevere pains
" and a violent fever, with a diſcharge of real bile,
" and proves fatal in a few days." And the ſame he affirms, in treating on a luxation of the cubitus, in his book of the articulations[r]. And in another place, treating on a luxation of the jaw, he obſerves[s], that it ought to be reduced with the utmoſt expedition; for if it be not replaced, the patient's life will be in danger from the continual fever: and he then adds, that theſe patients uſually void pure bile in ſmall quantities by ſtool, and if they vomit, they bring up the like humour.

Œdema.] It was ſaid in the commentary on § 112. numb. 1. that by this name even all preternatural tumours were called formerly; but that afterwards it was reſtrained to thoſe tumours only, which are ſoft, indolent, and yield to the preſſure of the fingers. Such a kind of tumour is generally ſeated in the cellular membrane only, from an accumulation of the lymph ſtagnating in the cells of that membrane. But luxations are generally accompanied with this tumour, when the diſlocated bone compreſſes the larger veins; for thus the motion of the venal juices is impeded, ſo that the thin dew exhaled by the arteries into the cavities of the cellular membrane, cannot be duly abſorbed by the veins, whence being accumulated and ſtagnant, it is converted into water or ichor, as it is termed by Hippocrates.

Anchyloſis.] Celſus[t] tells us, that joints contracted with a recent cicatrix or callus were by the Greeks termed ἀγκύλας: but that a ſtiffneſs or immobility of a joint was alſo called ἀγκύλας and ἀγκυλώσεις, we are told by Ægineta[u]; and that the cauſe was an infarction of the humours or a contraction of ſome of the ligaments. Anchyloſis therefore denotes an inflexibility

[r] Hippocrat. de fracturis, in fine libri. Charter. Tom. XII. pag. 331. [s] Ibid. pag. 340. [t] Lib. V. cap. 18. n° 28. pag. 257. [u] Lib. IV. cap. 55. pag. 70. verſa.

of

of a joint, which is frequently accompanied with a preternatural tumour. But for the joints to continue moveable, it is neceſſary for the heads of the bones to retain their proper figure and connection where they are articulated together, and to have their extremities evenly covered with a very ſmooth cartilage, lubricated with the proper liniment; and laſtly, the ligaments themſelves, which encompaſs the joint, muſt have a due degree of flexibility. But by luxations all theſe requiſites are ſometimes either deſtroyed or perverted: for the ligaments, being broke or violently diſtracted by the diſlocation of the bone, become inflamed, as they alſo may from that force which is required to extend the bones and reduce them. But this inflammation may terminate either in a ſuppuration or gangrene; whence the ligaments will afterwards remain rigid and contracted. Alſo this diſorder of the ligaments will impair the ſecretion of the lubricating mucilage of the joint, which will be leſs than uſual; whence again the motion of the joint will be impeded. While the ligaments are inflamed, moſt ſevere pains will ariſe from the leaſt motion of the joint, which being therefore kept at reſt, the liniment of the joint will not be ſufficiently attenuated and abſorbed; this therefore being accumulated, and deprived of its more thin and fluid parts, will at length concrete into an irreſolvable maſs, which will totally deſtroy the motion of the joint. If again the ſurface of the cartilage is wounded or abraded either in the diſlocation or reduction of the head of the bone, or is ſome other way injured, this may be another cauſe of an anchyloſis.

Convulſion.] The moſt acute pain, diſturbing the whole common ſenſory, is frequently attended with convulſions: as was ſaid before in § 226. and from hence a convulſion may follow a luxation. But beſides this, a luxation is often accompanied with a conſiderable diſtortion of the muſcles, and diſtraction of the tendons, which alone may be ſufficient to produce

a convulſion. For we know by daily experience, what a ſevere pain and contraction of a muſcle follows, commonly called the cramp, when any of the tendons of the muſcles moving the fingers or toes are diſplaced. Hippocrates [w] obſerves, that in a luxation of the bones of the leg, accompanied with a wound, if the heads of the bones next the foot are perfectly diſlocated either outward or inward, they ought not to be reduced; for if they are reduced, the patient ſurvives but a few days, and expires with convulſions. The ſame bad conſequence is to be expected, he ſays [x], if the bones of the cubitus are ſo diſlocated at the wriſt, that they burſt out through a wound: and he then adds [y], that if a convulſion follows the reduction of the bones, they ought ſpeedily to be diſplaced again, and the parts muſt be afterwards fomented at times.

A withering.] When the larger arteries or nerves tending to any part, are from ſome cauſe obſtructed, ſo that they cannot properly diſtribute their reſpective juices neceſſary for the life and nutrition of the parts, a true maraſmus or waſting of thoſe parts thence follows; ſince all the veſſels are contracted and collapſed, from their preſent juices being diſſipated, without any freſh ſupplies. A ſurprizing inſtance of ſuch a withering is related in the commentary on § 161. where the axillary artery being totally divided, the whole arm afterwards dried up like a mummy. When therefore, for inſtance, the head of the os humeri is ſo prolapſed as to compreſs thoſe large veſſels in the axilla for a conſiderable time, it is evident that the like accident may be reaſonably expected.

But Hippocrates [z] has alſo remarked another cauſe of this withering: namely, when the diſlocated bones have not been reduced. For, in treating of a luxation of the

[w] De Articulis, Charter. Tom. XII. pag. 435. [x] Ibid. pag. 443. [y] Ibid. pag. 445. [z] Ibid. pag. 203. & ſequentibus.

femur,

femur, he ſays, that if this happens to thoſe who are not yet grown to their full ſtature, and no reduction has been made, the thigh, leg, and foot is by that means rendered ſhorter; *neque enim oſſa ſimiliter in longitudinem augentur, ſed breviora ſiunt, femur præſertim. Crus item univerſum ſine carne et muſculis fit, et effœminatum et tenuius; partim quod articulus ſuo loco motus ſit, partim quod nequeat ſua munere fungi, quia non ſecundum naturam diſponitur. Nam uſus aliquis id, quod valde effœminatum eſt, confirmat; ſolvit etiam aliquid ex eo, quod augeri membrum in longitudinem prohibit. Potiſſimum autem læduntur, quibuſcumque, dum in utero ſunt, hic articulus elabitur; deinde quibus id accidit, dum in ætate ſunt admodum tenera; minime quam jam robuſti ſunt*; "for then the bones are not "equally augmented in their length, but they, and "eſpecially the femur, become ſhorter. The whole "leg alſo becomes feeble, ſlender, and almoſt with-"out fleſh or muſcles; partly becauſe the limb is "diſlocated, and partly becauſe its functions are diſ-"turbed or aboliſhed, from its veſſels being not na-"turally diſpoſed. For the uſe of any limb that is "feeble corroborates it; but every thing which pre-"vents the growth or elongation of the limb, cauſes "it alſo to decay or waſte. But thoſe have this in-"jury in the moſt conſiderable degree, who have "ſuffered a diſlocation of the femur while in the "uterus; and next, thoſe to whom this has happen-"ed when they were very young; but thoſe are the "leaſt injured hereby, who are already ſtrong and "luſty." But this withering, he obſerves [a], is chiefly ſeated in the parts neareſt to the diſlocated joint; which he proves by the inſtance of thoſe who have had a diſlocation of the humerus from the birth, or at leaſt before they have acquired their full growth; for in theſe the humerus is ſhorter, and the cubitus, with its adjoining hand, ſomething leſs than the ſound. He likewiſe adds, that they can generally perform

[a] De Articulis, Charter. Tom. XII. pag. 408.

moſt kinds of work almoſt as well with the injured as with the ſound limb: But when the head of the femur is diſlocated inwards, he ſays, that the fleſh is waſted the more, becauſe they cannot uſe the limb. Hence that withering which follows the diſlocation of a joint, which has not been reduced, cannot be always aſcribed to the compreſſion of the larger veſſels, but it often reſults likewiſe from the defect of the muſcular motion in the limb thus injured: and therefore Hippocrates [b] remarks, that when the femur is diſlocated outwards in adults, and has not been reduced, the bulk or fleſhyneſs of the parts is not ſo much diminiſhed, becauſe the limb does not loſe its motions or uſe. For the fleſhy parts, amongſt which the head of the bone is protruded, become at length tough and firm by attrition, ſo that the patient can ſtand or walk on it without a ſtick. But after this, Hippocrates [c] deduces a general axiom from theſe obſervations, and ſays: *Quæcumque in corpore ad aliquem uſum facta ſunt; ſi quis moderate utatur, exerceatque in eo laboris genere, cui ſingula aſſueverunt; hoc pacto bene valent, augentur, et ad bonam ſenectutem deducuntur. Si in uſu non ſint, ſed otioſa maneant, morboſiora fiunt, non augentur, et brevi ſeneſcunt: id præcipue accidit nervis atque articulis, niſi quis illis utatur*; "Every part of the body made for ſome action, being moderately uſed, and exerciſed in that ſort of work to which each part is accuſtomed, does by that means become healthy, increaſe in bulk, and conduce to a good old age: But if they remain idle, and without exerciſe, they become more diſeaſed, do not grow luſty, and bring age on apace; and this holds true principally in the ligaments and joints, unleſs a perſon uſes them." But what a conſiderable effect exerciſe has, in reſtoring from the aliments thoſe parts which are continually waſted by the actions of a living and healthy body, has been al-

[b] De Articulis, Charter. Tom. XII. pag. 411. [c] Ibid. pag. 42.

ready

ready demonſtrated in the commentary on § 25, numb. 2. and § 28. numb. 2. If again we alſo conſider, that the tendons, muſcles, ligaments, *etc.* contract or ſhorten, and at length become rigid if they are not moved; and that the veſſels of our bodies collapſe, and cloſe by their own contractile power, from a diminution of their diſtending cauſes; it will be from thence evident why the parts ſhrink or waſte, after the motion of a limb is impeded by a luxation.

All that Hippocrates has ſaid in different places concerning this withering of the parts, is collected together by Celſus[a], and expreſſed in a manner no leſs conciſe than elegant: *Ac, quibus in puerita exciderunt (articuli) neque repoſiti ſunt, minus quam cæteri creſcunt: omniumque, quæ loco ſuo non ſunt, caro emacreſcit, magiſque in proximo loco, quam in ulteriore; ut puta, ſi humerus loco ſuo non eſt, major in eo ipſo fit macies, quam in brachio; major in hoc, quam in manu. Tum pro ſedibus, et pro caſibus, qui inciderunt, aut major aut minor uſus ejus membri relinquitur: quoque in eo plus uſus ſupereſt, eo minus id extenuatur*; "As for "limbs which have been diſlocated in childhood, and "which have not been replaced, they grow leſs than "the reſt; for the fleſh or muſcles of every diſtorted "limb conſumes or falls away, and this more in the "parts near the luxation than in thoſe which are "more remote: As for inſtance, if the humerus is "diſplaced, there happens a greater waſting in that "than in the fore-arm, and a ſtill greater in the fore-"arm than in the hand. Add to this, that more or "leſs of the action of the limb remains, according "to the different ſeats and cauſes of the luxation; "and likewiſe, the more the action of the limb re-"mains, the leſs is it extenuated or waſted."

The obſervations of the moſt ſkilful ſurgeons likewiſe confirm this doctrine. A youth ſitting down in a meadow, was drawn by the leg by a playful girl,

[a] Lib. VIII. cap. 11. pag. 544.

whereupon

whereupon a pain enſued in the articulation of the femur, which was yet but ſlight. A very ſkilful ſurgeon being called, upon the ſtricteſt examination could find no ſigns of a luxation, but imagined the pain aroſe from the diſtraction of the muſcles and ligaments inveſting the articulation; and therefore he only applied ſome linen cloths dipped in ſpirit of wine to the affected parts, and retained them by a ſuitable bandage. The careful mother, who expected to have ſeen a much more formidable apparatus uſed, called in a country fellow, who was by the ignorant common people believed to be a great maſter in reducing luxations. The ruſtic ſo forcibly extended the falſly ſuppoſed diſlocated limb that he actually diſplaced the head of the femur inwards from its cavity; as it evidently appeared, after the ſevere pain, tumour, and inflammation of the parts were removed by proper remedies. For the injured leg was two inches longer than the ſound one. As the patient was not yet arrived to his full growth, the ſurgeon predicted that there would be a deficiency in the future growth of the injured limb in proportion to that of the reſt of the body: the truth of which aſſertion was afterwards proved by the event; for when the whole body was grown four inches higher, the injured leg was about two inches ſhorter than the ſound, notwithſtanding they were at the reduction both of the ſame length [e].

Death of the part or of the whole body.] Among the effects or conſequences of pain, we reckoned a gangrene § 226. which is that ſtate of the ſoft parts in which they tend to death or mortification, by being deprived of their vital influx of blood, by the arteries and reflux of the veins. The ſame diſaſter alſo frequently happens from a violent inflammation, which is ſo general an attendant on luxations. When the bones of the leg are diſlocated at the foot with a wound, Hippocrates [f] obſerves, that to attempt a re-

[e] De la Motte Traité complet. de Chirurgie, Tom. IV. pag. 367—375. [f] De Articulis, Charter. Tom. XII. pag. 437.

duction

duction would cauſe a gangrene to invade the leg and foot. If therefore the larger veſſels are ſo compreſſed or injured by the luxation, as to intercept the vital influx and reflux of their juices, a death or mortification of the part is at hand; as it alſo is when the reduction of the bones is attempted while the violent inflammation continues. For the ſtrong extenſion and rough handling which are required in the reduction, often cauſe the inflammation to turn ſpeedily to a gangrene. An unfortunate caſe of this nature is related by the ſagacious author lately cited. An unſkilful perſon attempted to reduce the elbow, which was diſlocated in a ſervant man the day before, and this notwithſtanding a violent inflammation occupied the adjacent parts of the articulation; for he had called in to his aſſiſtance two ſtrong men, who moſt violently extended the part. By the next day a gangrene had extended itſelf up to the middle of the arm, and the patient's life could be ſaved no other way than by amputating the limb. But that death itſelf of the whole body is likewiſe often the conſequence, may ſufficiently appear from what has been already ſaid in the commentary on this aphoriſm: for we obſerved that a luxation of the jaw is often attended with violent convulſions and death; and Hippocrates obſerved, that violent fevers ariſe after a diſlocation of the cubitus. The ſame he alſo obſerves, when the larger bones are ſo diſlocated that they ſtart through a wound; for then convulſions and death are at hand if they are replaced; and if they are let alone, even then life is often in danger.

SECT. CCCLXV.

FROM a knowledge of all which ſymptoms, we are furniſhed with the demonſtrative ſigns of a preſent luxation.

[s] De la Motte, &c. Tom. IV. pag. 359.

Two

To be ſatisfied of the luxation of any joint, the firſt enquiry muſt be whether a cauſe ſufficiently violent has preceded, by the force of which the head of the bone might be diſplaced: and whether this cauſe was external (§ 361.) or internal, reſiding in the cavity of the articulation (§ 362.) And then enquiry muſt be made whether the articulating ligaments have been overſtrained or broke by a too violent external force preceding; or whether the ligaments are ſo relaxed from any cauſe, that they do not firmly retain the joint which they inveſt, of which we ſpoke in § 363. After it appears from hence, that there is juſt ground to ſuſpect a luxation, we muſt then diligently enquire after thoſe ſigns which demonſtrate that a luxation is preſent. And the chief of theſe are a preternatural tumour from the head of the bone being diſplaced into ſome other part, with an unuſual cavity in the place where the head of the bone was naturally ſeated. But to make the diagnoſis certain, both theſe ſigns ought to attend; for either of them alone is often found fallacious. We gave an inſtance of ſuch an error in the commentary on the preceding aphoriſm, committed on no leſs a perſon than Galen himſelf, whoſe humerus was miſtakenly ſuppoſed to be luxated, from the appearance of a preternatural cavity made by the diſtortion of the acromion, without any unuſual tumour appearing in the adjacent parts. And thus I ſaw an inflammatory tumour formed in the groin by a fall, miſtaken for a luxation of the femur; when at the ſame time the girl being of a lean habit, one might eaſily perceive by the touch that the articulation was right, and that there was no preternatural cavity. It is a ſtrong confirmation of the diagnoſis, when the motion of the limb, which depends on the natural conformation of the joint, is totally deſtroyed, or elſe very much depraved. And if at the ſame time, by comparing the injured limb with that which is ſound, there appears a conſiderable difference

in

in their figure and length, there ſeems then to be no room to doubt of a luxation.

The diagnoſis of a luxation is however ſometimes very difficult: for if the inflammation ariſing from a violent contuſion, diſtortion, *&c.* has cauſed a conſiderable tumour to be formed round the joint, it will be neither eaſy to perceive the protuberance nor the preternatural cavity which is there formed; while at the ſame time all the motions of the joint are prevented by the intenſe pain. In ſuch a caſe, therefore, one ought chiefly to conſider whether the antecedent cauſe was ſuch, as that one might from thence reaſonably expect a luxation. Nor will it be of any bad conſequence to ſuſpend our judgment in ſuch a doubtful caſe; becauſe the violence of the inflammation will render it dangerous to reduce the luxation: therefore that ought firſt to be removed by proper remedies, and then the affected parts may be more diſtinctly examined.

But how much caution is often required in diſtinguiſhing luxation, is evident from the caſe which Galen[a] relates. A man diſlocated his arm in the field of exerciſe: the phyſician upon comparing the injured limb with that which was ſound, could perceive no difference; whence he too haſtily concluded that the part was injured with a contuſion, but that the articulation was ſound. He therefore ordered the patient to the bath, and after covering the part with woollen cloths dipped in wax and oil, to compoſe himſelf to reſt. But as by theſe means the pain did not abate all night, on the day following, the phyſician full of indignation (becauſe others more unſkilful than himſelf were conſulted) readily confirmed and perſiſted in the diagnoſis which he made the day before, and ſaid, that the humerus was inflamed by the pain, and that therefore he would have the ſame means continued. But on the third day, the pain

[a] In Commentario primo in librum Hippocrat. de Officina Medici. Charter. Tom. XII. pag. 6.

being

being nothing abated, and Galen being called into conſultation, he found indeed, that the affected ſhoulder had no preternatural cavity in the place of the articulation, but it was rather more tumid than the other ſhoulder; but thruſting his fingers under the axilla, he immediately perceived the head of the humerus was lodged there, and therefore determined there was a luxation. It was the compariſon of the injured limb with that which was ſound, which deceived the firſt phyſician; whereas upon Galen's enquiry, the patient owned, that by a fall from a chariot he had formerly broke off the acromion of the other ſhoulder, which the phyſician ſuppoſed to be ſound and natural, though it had thence an apparent excavation; ſo that by comparing the two ſhoulders together, the ſame cavities appearing in each, led the firſt phyſician into an error.

After the exiſtence of the luxation is aſcertained, it is farther required in the diagnoſis to determine towards which part the bone is prolapſed, whether inwards, outwards, upwards, downwards, *&c.* for many things neceſſary towards the prognoſis and cure depend on this determination. Much light will be afforded in this affair from the anatomical knowledge of the various connections and articulations of the bones, with a conſideration of their movements reſulting from the particular diſpoſition of each joint. But the particular quarter towards which the head of the bone is diſplaced, may be alſo determined from the ſame conſideration of their motions; and therefore Hippocrates, and all the beſt proficients after him, have very diligently collected all the ſigns by which one may diſtinguiſh the different modes of diſlocation in the ſame joint. Thus, for inſtance, he obſerves, that if the injured arm cannot be extended, the cubitus is diſlocated backwards; and, on the contrary, that when the joint is luxated forward, the cubitus cannot be inflected: [b] and in treating on the ſe-

[b] Hippocrat. de Articulis, Charter. Tom. XII. pag. 331.

ſeveral

veral luxations of the femur[c], he accurately remarks the ſigns proper to each, *etc.* which ſeem unneceſſary to be here repeated.

SECT. CCCLXVI.

AND from having conſidered the ſize, figure and ſituation of the accident, with the intercepted or compreſſed parts; the age of the diſlocation, and its degree of concretion; with the pain, inflammation, convulſion, or other ſymptoms in the circumveſting parts, which are of a more or leſs ſlender or groſs texture; alſo the ligaments themſelves, being either broke or elongated, with their annexed muſcles, *&c.* From all theſe is deduced a prognoſis indicating whether the cure will be compleat or defective; ſpeedy or ſlow; and eaſy or difficult.

After the luxation is apparently demonſtrated by the diagnoſtic ſigns, every circumſtance mentioned in this aphoriſm ought then to be duly conſidered, in order to form a certain prognoſis of the bad conſequences that may be feared from the known luxation, or from that force which will be neceſſary to reduce the diſlocated bones. For all theſe ought to be intimated, at leaſt to the patient's friends, if not to himſelf, leſt the ſupervening accidents, which are by no means avoidable, ſhould be imputed rather to ignorance or neglect in the ſurgeon, than to the violence of the diſorder. But the principal enquiry in the prognoſis is, whether ſuch a cure may be expected, that the limb will afterwards recover all its uſual motions; or whether only ſome of the uſual motions of the diſlocated limb will remain, and thoſe not abſolutely the ſame as they were before the luxation. For thus is diſtinguiſhed whether the cure will be

[c] Hippoc. de Articulis, Charter. Tom. XII. pag. 368. & ſequent.

compleat

compleat or defective. It ought alſo to be further determined, whether the cure may be compleated in a ſhort ſpace of time, or whether a longer interval will be required to reſtore the limb to its due ſtrength. For if, for example, the ligaments have been violently ſtrained, or otherwiſe relaxed, ſo as to loſe their ſtrenth before the accident, a ſpeedy cure cannot be expected. But the cure may be ſaid to be eaſy when only a ſlight extenſion is neceſſary to reduce the luxation, which is not attended with any very bad ſymptoms. But, in the contrary caſe, one may juſtly foreſee, that the cure will be attended with difficulty when it requires a violent extenſion, and moſt or all of the aſſiſtances of art. "It is the buſineſs of a quack "to magnify a ſlight caſe, that his performance may "appear the more conſiderable," ſays Celſus [a]. *Hiſtrionis quidem eſt, parvam rem attollere, quo plus præſtitiſſe videatur*; but it can never be amiſs to repreſent the prognoſis rather on the more difficult ſide; for if the ill conſequence ſupervenes, they will reflect that it was predicted to them: but if every thing ſucceeds happily, the happy event will merit praiſe to the ſurgeon. But what conſequences are to be feared, will be evident from the following conſiderations.

Size or magnitude.] The magnitude of a luxation is meaſured by the diſtance which is intercepted betwixt the head of the bone, and the cavity from whence it was diſplaced. But it is evident, that the farther a bone has receded from its cavity, in which it naturally moved, the more will the inveſting ligaments be diſtended, even ſometimes to a rupture; and the greater diſtraction alſo will the adjacent tendons and muſcles ſuffer, whence extreme pain, inflammation, *etc.* follow. It is alſo equally evident, that a luxation may be the more eaſily reduced, as the head of the bone is nearer to the cavity from whence it was diſplaced. Whence Celſus obſerves [b],

[a] A. C. Celſi. Medic. Lib. V. cap. 26. pag. 283.
[b] Lib. VIII. cap. 15. pag. 549.

it

it will be much more eaſy to reduce the humerus when it is diſlocated forwards, than when its head is prolapſed into the axilla.

Figure.] It was ſaid before (on § 364.) that a luxation is attended with an alteration of the figure of the limb; therefore the greater this alteration, which is obſerved by comparing the ſound and injured limb together, ſo much the greater change is there in the ſituation of all the circumjacent parts, and ſo much greater is their extenſion or diſtortion; all which will apparently augment the difficulty of the cure. But the figure of the diſlocated joint itſelf may cauſe a great deal of difference in this reſpect; as for inſtance in a diſlocation of the humerus, if the head of the bone is lodged before its proper cavity, by relaxing the parts after a due extenſion is made, the bone eaſily ſlips into its place. But in the os femoris the caſe is very different. For the head of that bone with its ſlender neck forms an obtuſe angle with the reſt of the deſcending body of the bone; whence it will be here neceſſary to uſe another artifice. For though by a forcible extenſion the diſplaced head of the bone may be brought over againſt its proper cavity, yet it may very eaſily ſlip upwards and paſs over its laterally placed cavity: whence Hippocrates [c], treating of the reduction of the os femoris when diſlocated inwards, ſo diſpoſes the whole apparatus, as that the ſurgeon's hand may preſs laterally and urge the bone into its place when the head comes over againſt its cavity.

Situation.] If we conſider thoſe wiſe obſervations which Hippocrates [d] has made concerning the different directions of a luxated femur, it will ſufficiently demonſtrate what a conſiderable difference may ariſe in the effects of a luxation from this cauſe only. For if the femur is diſlocated inwards, and cannot be replaced, (as it frequently happens,) then the muſcles or fleſh, which encompaſs the diſlocated bone, fall away,

[c] De Articulis, Charter. Tom. XII. pag. 455.
[d] Ibid. pag. 399. & ſequentibus.

and the action of the limb will be much vitiated. But the ill conſequence will be much leſs if the head of the femur is diſlocated outwards: and therefore Hippocrates* makes this general inference; *Circa coxas magna differentia eſt, verſus interiora aut verſus exteriora, luxatum eſſe: circa genua quidem differt, ſed minus. Modus autem claudicationis utriſque proprius eſt: nam quibus in exteriorem partem procidit, vari magis fiunt; minus autem recti ſtant illis, quibus in interiorem partem luxatur. Similiter autem & ſi circa talum luxatio facta fuerit; ſi enim verſus exteriorem partem, vari quidem fiunt, ſed ſtare queunt. Si verſus interiorem partem exciderit, valgi quidem fiunt, minus vero ſtare poſſunt*; "With reſpect to the hip or joint of the femur "there is a great deal of difference, according as it is "luxated either inwards or outwards; and with re- "ſpect to that of the knee there is alſo a difference, "but leſs than in the former. But there is a particu- "lar mode of halting proper to each of theſe: for "thoſe who have the femur diſlocated outwards, have "their leg turned rather inwards; but thoſe do not "ſtand ſo upright, who have the femur luxated in- "wards. The ſame likewiſe holds in a luxation of "the ankle; for if the foot be diſlocated outward, "they can ſtand, and are termed *vari:* if it be diſlo- "ted inwards, they cannot ſo well ſtand, and they "become *valgi.*"

The parts compreſſed or intercepted.] What ſad diſorders may follow, when diſlocated bones compreſs the adjacent parts, is no where more evident than in a luxation of the vertebræ of the ſpine; for then the ſpinal medulla included within their cavity is compreſſed, contuſed, and ſometimes wounded. And here the conſequences are always more fatal, as the luxation is ſeated higher up towards the head: and therefore a luxation of the head itſelf, (by the ſlipping back of its glenoide proceſſes, by which it is connected to the uppermoſt of the vertebræ,) is by Cel-

* De Articulis, Charter. Tom. XII. pag. 406.

ſus [r] juſtly pronounced fatal. *Nervi ſub occipitio extenduntur, & mentum pectori agglutinatur, neque bibere is, neque loqui poteſt: interdum ſine voluntate ſemen emittit, quibus celerrime mors ſupervenit*; "The nerves "below the occiput are extended or obſtructed, the "chin is preſſed cloſe to the breaſt, nor can the pa- "tient either drink or ſpeak; and ſometimes there "is an involuntary diſcharge of the ſemen, which "ſymptoms are ſoon followed with death." And he afterwards obſerves [s], that thoſe are much in the ſame condition who have a luxation of the vertebræ of the ſpine, but that they do not die ſo ſoon as one who has luxated the head, but yet that they die within three days time. He alſo there enumerates thoſe very bad conſequences which follow a perfect luxation of the vertebræ; that is, when they are wholly diſplaced: for then he ſays, the ſpinal medulla, its membranes and nerves, muſt of neceſſity be ruptured. But if the vertebræ are only diſtorted a little outwards, he propoſes a method of cure out of Hippocrates. See alſo upon this ſubject what has been ſaid in the commentary on § 364. concerning the numbneſs and palſy of the parts below the diſlocated joint. But if in reducing the diſlocation the parts of a nerve, tendon, muſcle, blood-veſſel, or the like ſhould be unfortunately intercepted betwixt the bones, it is evident that the moſt excruciating pains, convulſions, *&c.* may thence follow. But ſuch an interception cannot eaſily happen, if a due extenſion of the parts precedes the reduction of the luxation.

Age or continuance.] Hippocrates [t] lays it down as a general rule, that luxations ought to be reduced immediately, or at leaſt as ſoon as poſſible. For he obſerves, that the reduction may be more eaſily made before the part begins to ſwell, and the patient will then likewiſe ſuffer leſs pain. And the moſt celebrated ſurgeons, who always provide their whole appa-

[r] Lib. VIII. cap. 13. pag. 546. [s] Ibid. cap. 14. pag. 547.
[t] De Articulis circa finem. Charter. Tom. XII. pag. 466.

ratus of dreſſings in order, before they reduce a fracture, do nevertheleſs immediately reduce a luxation, and then provide the neceſſary bandages and other things proper for retaining the reduced bones[i]. Even if a fracture ſhould unluckily accompany a diſlocation, the latter is always reduced before the fracture is touched; partly for the foregoing reaſons, and partly becauſe the reduced fragments might be diſplaced again by the force required to reduce the luxation[k]. But if the joint has continued diſlocated for ſome time, the parts affected ſoon ſwell, inflame, and become extremely painful; whence there might be danger of inducing a gangrene by a rough handling. Alſo the ligaments, which have been long diſtracted, loſe their ſtrength; whence the reduced joint may be very eaſily diſlocated again. And the conſiderable glands, which are ſeated in the larger articulations, being ſet free from the compreſſure by the head of the bone, or elſe inflamed, may ſwell ſo as to greatly diminiſh the cavity of the joint; whence the reduction will become difficult, and the retention ſtill more difficult. Add to this, that the mucilage or liniment lubricating the joint, and which uſed to be attenuated and diſperſed by its conſtant motion, will now be accumulated, and often reduced into ſo thick a maſs, that it can afterwards be diſſolved by no art, but fills up the cavity of the joint, ſo that there is no longer any room for receiving the head of the bone. If again it be conſidered that an inflammaton often follows, unleſs the luxation is ſpeedily replaced, which may cauſe a deep ſuppuration, (as Hippocrates[l] obſerves in treating on a luxation of the thigh,) the reaſon will be very evident why many bad conſequences may be foreſeen in the prognoſis, if the diſlocation continues any conſiderable time before its reduction is attempted.

[i] De la Motte Traité complet de Chirurgie, Tom. IV. pag. 358.
[k] Ibid. pag. 398.
[l] De Articulis, Charter. Tom. XII. pag. 411.

A con-

A concretion.] It is well known that all parts of the body contiguous to each other are prevented from growing together by the intervention of a thin vapour like dew, which repleniſhes all the larger and ſmaller cavities of the body. But when this dew is abſent, the parts which were before ſeparated ſoon grow to each other. Now when the parts are inflamed, the great diſtention of the larger veſſels compreſſes theſe ſmaller exhaling ones: whence follows that dryneſs of the parts in inflammations, which cauſes them readily to cohere and grow together. Thus the lungs are almoſt conſtantly found adhering to the pleura after a pleuriſy or peripneumony. Therefore the head of the bone now diſplaced, and deprived of its natural liniment, will readily cohere and grow to the adjacent parts, which are alſo at the ſame time inflamed by the violent diſtraction or compreſſion which they endure. From whence it is evident that the reduction muſt be then impracticable. But we have already ſeen, that the cavity of the joint likewiſe may be ſoon filled by a luxuriancy of the glands or an inſpiſſation of the mucilage. And perhaps too the bony cavity itſelf may ſhrink and grow gradually leſs from the abſence of the diſlocated head of the bone; for we ſee, that after the evulſion of a tooth, the ſides of the jaw compoſing the alveoli do by degrees cloſe and meet together, till they are at length ſo united, that no mark of the ſocket of the tooth remains.

Pain.] A recent luxation is always accompanied with pain, as we ſaid before in the commentary on § 364. But if this pain is extremely excruciating, the worſt events may juſtly be feared: becauſe it denotes that the aching parts are in ſuch a ſtate as tends to a total diſſolution of their continuity, (ſee § 220.) Alſo the worſt conſequences of extreme pain, enumerated in § 266, may be thence expected; more eſpecially as the reduction of the luxated bones requires a forcible extenſion of the parts already full of

pain; whence there may be danger of convulſions, delirium, a gangrene, &c.

Inflammation.] How an inflammation comes to be a conſequence of a luxation has been explained in the commentary on § 364. For it is almoſt a conſtant attendant, unleſs the diſlocation was ſpeedily reduced. But when a violent inflammation has invaded the diſlocated part, it is in the utmoſt danger. For unleſs the luxation is reduced at firſt, it will be very difficult to do it afterwards: and if the parts are roughly handled during the inflammation, a gangrene may follow in a little time. But in ſuch a caſe, of two evils the leaſt it is to be choſe; and therefore it will be beſt to relinquiſh the reduction until the inflammation is removed or abated by proper remedies. This is alſo the opinion of Hippocrates [m], who, in treating on the moſt dangerous luxations, ſays, *Eodem die reſtituendæ ſunt, vel ſequenti; tertio vero aut quarto minime. Ubi enim uſque ad quartum diem duraverint, maxime recrudeſcere videmus. Ubi ergo non protinus recondantur, his diebus ſuperſedendum eſt. Contineri enim ſolet, quod intra decem dies conditur*; "That they are "to be reduced the ſame day or the day after; but "by no means on the third or fourth day. For "when they have been neglected until the fourth "day, we have obſerved the worſt ſymptoms attend. "If therefore they are not immediately reduced, "thoſe days are to be paſſed over in expectation; for "it uſually happens that they may be reduced within "ten days." And in another place [n], ſpeaking of a luxation of the cubitus, he lays it down as a general rule: *quod nullum articulum, dum febris adeſt, in ſuam ſedem reducere conveniat, & omnium minime cubitum*; "That it is not proper to reduce any luxation while "the fever continues, and above all, not to reduce "that of the cubitus." But a fever is both a ſign and attendant of a violent inflammation, which ac-

[m] De Articulis, Charter. Tom. XII. pag. 445.
[n] De Fracturis, Charter. Tom. XII. pag. 267.

companies

companies a luxation. The ſame is alſo the advice of Celſus [o], when he ſays, *Quidquid autem loco ſuo motum eſt, ante inflammationem reponendum eſt. Si illa occupavit, dum conquieſcat, laceſſendum non eſt: ubi finita eſt, tentandum eſt in his membris, quæ id patiuntur*; "But "whatever is diſlocated ought to be replaced before "the inflammation appears: but when that has inva- "ded the parts, it ought not to be moleſted till it is "appeaſed: and when it is over, trial may be made "what can be done with the diſlocated limb." In the commentary on § 364, we related a caſe, in which a very bad gangrene followed the reduction of the cubitus, while the parts were in a ſtate of inflammation. In ſuch a caſe therefore the reduction ſhould be poſtponed, and the patient or his friends acquainted with the danger that is threatned by ſuch an attempt; but that the cure may be difficult afterwards, and often not compleat: and this to prevent any reflection on the phyſician or ſurgeon. For though a luxation ought to be reduced as ſoon as poſſible, when nothing forbids; yet obſervations teach us, that we ought not wholly to deſpair, when the joint has been a long time diſplaced. For a luxation of the humerus, accompanied with a violent inflammation, could not be reduced till after the expiration of two months time; but yet a compleat cure was made of ſo inveterate a malady [p]. But what obſtinate ſymptoms follow the extenſion of a joint while it is inflamed, is demonſtrated in ſeveral inſtances by Hildanus [q].

Convulſion and other bad ſymptoms.] That a convulſion ſometimes follows a luxation was ſaid in the commentary on § 364. and this eſpecially from extreme pain and a violent extenſion or diſtortion of the tendons or muſcles. But of what conſequence a convulſion may be, we declared in the commentary on § 233. But it is evident that no attempt can be

[o] Lib. VIII. cap. 11. pag. 544.
[p] La Motte Traité complet de Chirurg. Tom. IV. pag. 354.
[q] Centur. 2. Obſerv. 90. pag. 168.

made to reduce a luxation during convulſions, becauſe the pain would be then violently increaſed as well as the diſtraction of all the parts; and therefore the convulſive cauſes would be thence increaſed. But the antient phyſicians were ſo fearful of convulſions in theſe caſes, that Hippocrates [r], and even Celſus [s] after him, even ſays, *ſi quoque, repoſito oſſe, nervi diſtenduntur, rurſus id protinus expellendum eſt*; "That if a "convulſion follows after the bone is reduced, it "muſt be immediately diſplaced again." And Hippocrates in another place [t] ſeems for this reaſon to pronounce a luxation of the jaw fatal in thoſe who are ſubject to cramps, and to be convulſed backwards: for then this luxation cannot be reduced becauſe of the cramp; and if it is not reduced life is in danger, as was ſaid in the commentary on § 364.

If now a violent fever, faintings, hiccups, *&c.* attend over and above the ſymptoms now enumerated, it is evident, that to reduce a luxation cannot be ſafely attempted, and that therefore the prognoſis muſt be hard.

The inveſting parts being thinner or thicker.] It was ſaid before from Hippocrates in the commentary on § 363. that fleſhy joints do not ſo eaſily ſlip out, but then they are more difficult to replace when out. Therefore the luxations of thoſe larger joints are the moſt dangerous, which are encompaſſed with large muſcles, and confined by ſtrong ligaments. For ſuch joints cannot be diſlocated but by the greateſt violence; whence the moſt dangerous ſymptoms often follow. Hence it is that Celſus [u], treating of thoſe luxations which are accompanied with a wound, ſays, *Hic vero & ingens periculum eſt, & eo gravius, quo majus membrum eſt, quove validioribus nervis aut muſculis continetur. Ideoque ab humeris, femoribuſque,*

[r] De Articulis, Charter. Tom. XII. pag. 445.
[s] Lib. VIII. cap. 25. pag. 557.
[t] Coac. Prænot. n°. 361. Charter. Tom. VIII. pag. 872.
[u] Lib. VIII. cap. 25. pag. 557.

metus

metus mortis eſt; *ac ſi repoſita ſunt oſſa, ſpes nulla eſt*; *non repoſitis tamen, nonnullum periculum eſt*; "But "here the danger is great, and the more as the limb "is larger, and confined by ſtronger ligaments and "muſcles. And therefore in ſuch luxations of the "humerus or femur the patient's life is in danger; "inſomuch that if the bones are replaced there are "no hopes; and if they are not replaced there is alſo "ſome danger." And in treating on a luxation of the thigh, he ſays*, *Magnum autem femori periculum eſt, ne vel difficulter reponatur, vel repoſitum rurſus excidat, &c. cum ibi valentiſſimi nervi muſculique ſint, ſi ſuum robur habent, vix admittere ut reponantur*; *ſi non habent, repoſitum non continere*; "But there is great "danger in a luxation of the femur, becauſe it is very "difficult to reduce, or when it is reduced, it may be "again diſplaced, *&c.* and as the tendons and muſcles "are here very ſtrong, they ſcarce admit of being "replaced, provided they have their due ſtrength; "and if they have not their due ſtrength, the reduced bones cannot well be retained in their ſituations." From hence it is evident, that attention muſt be given to theſe particulars in forming a prognoſis.

A rupture or elongation of the ligaments.] If the confining ligaments of the joint have been ſo much ſtretched as to ſuffer the bone to ſlip out of its ſeat, they may be afterwards contracted and reſtored to their former ſtrength, provided they are not broken; but if they have been quite broke, there is great danger leſt the recent wounded lips ſhould grow to the bones or to the adjacent parts, or leſt the cicatrix of the late wound ſhould render the ligaments leſs flexible; whence the eaſy motion of the joint would be afterwards impeded. Thus, for example, a luxation of the os femoris can ſcarcely be ſuppoſed to ariſe ſuddenly from ſome external violence without breaking the round ligament which ariſes out of the acce-

* Lib. VIII. cap. 20. pag. 554.

tabulum,

tabulum, for certain it is, that a luxation may ariſe from a gradual elongation and weakneſs of the ligaments from ſome cauſe ſeated in the cavity of the joint itſelf. Hence the difficulty of cure in this caſe is evident, for it is very ſeldom that the contracted ends of the broken ligament grow together again; from hence again the reduced bone may be afterwards more eaſily diſplaced. But when the diſlocated bones appear through a wound of the integuments, the caſe is then very difficult, eſpecially if their ligaments are entirely divided, inſomuch that Hippocrates* deſpairs of a cure in ſuch luxations: for he ſays, *Quibus autem cruris oſſibus luxatis, & vulnus facientibus, penitus excidunt articuli, qui circa pedem ſunt, ſive in interiorem, ſive in exteriorem partem, tales non ſunt reponendi, ſed ſinendum eſt, ut ille medicus, cui hoc placet, reponat. Scire enim licet, quod moriatur, ſi repoſiti ſerventur, & paucorum dierum vita fiet. Pauci enim ſeptimum diem excedunt. Convulſio enim occidit*; "But in thoſe luxations of the bones of the leg, in which the articulation is perfectly diſplaced, and accompanied with a wound near the foot, whether towards the internal or external ankle, theſe ought not to be reduced, but to be left to the care of the phyſician who attends; for it is to be obſerved, that the patient dies if the bones are replaced, or at moſt they ſurvive but a few days, for not many of them exceed the ſeventh day, being taken off with convulſions." He obſerves, that the only hope which then remains is, when the diſlocated bones of the joint are not replaced, for then the patient may be preſerved, though not without an unſightly lameneſs remaining during their life-time afterwards. He obſerves likewiſe, that there is the ſame danger when the bones of the arm are diſlocated with a wound; and ſays, that theſe luxations are the worſt when they happen in the bones of ſtrong people; ſo that if the femur is diſlocated at the knee, a reduction of it will

* De Articulis, Charter. Tom. XII. pag. 435.

kill

kill the patient ſooner than in other caſes; and if there is no reduction, the danger will be ſtill more imminent than in other caſes[r]. He adviſes to attempt the cure of luxations only in the fingers and toes, when they perforate the ſkin with a wound: but even then not without great caution, becauſe the bones afterwards ſuppurate, whence the phyſician might gain diſcredit; and therefore he ought not to be over-forward in attempting to reduce thoſe luxations. But extraordinary events demonſtrate, that we ought not always to deſpair in theſe caſes, eſpecially if ſuch a luxation is accompanied with a rupture of the ligaments in the lower joints. A very active woman jumped down on her feet from a high tree, which occaſioned a large ecchymoſis in the left leg from the toes to the middle of the thigh; but the right leg, pitching only upon the ankle, was ſo twiſted, that the os tibiæ ſtarted through the integuments to the length of three or four fingers breadth, and alſo ran into the earth; at the ſame time too the fibula was fractured at about the diſtance of two fingers breadth from the joint. The violent contuſion and laceration of the parts occaſioned the expert ſurgeons to conclude that the part muſt be amputated; but as the patient was in the flower of her age, of a ſtrong and healthy habit, and the diſorder ſeated towards the lower part of the limb, therefore a reduction of the fractured and diſlocated bones was attempted: for there was a fair opportunity of waiting to ſee if there might be hopes of a cure, ſince the gangrene, which was here juſtly expected, very ſeldom comes on ſo faſt, but that it may be afterwards ſucceſsfully extirpated. But beyond all expectation the pains were mitigated, and convulſions prevented by uſing the beſt remedies; ſo that by an exfoliation of the divided parts of the tibia and fibula, which had been expoſed to the common air, this woman happily eſcaped from ſo dangerous a malady, inſomuch that ſhe could afterwards walk, and perform

[r] De Articulis, Charter. Tom. XII. pag. 444, 445, 446.

her

her wonted buſineſs, though with a ſtiffneſs remaining in the joint of the foot[z]. It is yet ſufficiently evident how difficult and dangerous luxations are, in which the ligaments are deſtroyed.

The annexed muſcles.] For if very ſtrong muſcles are ſeated about the joint, it cannot be diſlocated but by the moſt violent cauſes, from whence the muſcles are often ſo much diſtracted, that they do not afterwards recover their priſtine ſtrength, or, at leaſt, they receive it but very ſlowly; and therefore there will always remain a deficiency in the motion of the diſlocated joint for the future. Thus, for inſtance, it is known from anatomy, that one of the tendons of the biceps muſcle of the arm ariſes from the upper and outward part of the ſinus in the ſcapula, into which the head of the os humeri is received, and paſſing through the ligamentary capſule, over the head of the bone, it proceeds to the ſinus or groove in that bone, and from thence emerging, it then becomes a fleſhy belly, and unites with the other head of the ſame muſcle. If now the head of the humerus is diſlocated forwards, it is very evident that this tendon of the biceps will ſuffer a great diſtention, whence the motion of the joint will perhaps remain for the future in ſome meaſure diſturbed.

Having thus pointed out the principal ſources from whence the prognoſis of luxations may be deduced, it now remains for us to treat of their cure.

SECT. CCCLXVII.

IN order to which is required, 1. a reduction of the diſlocated bones, and 2. a retention of the replaced bones in their proper ſituations, in order to compleat the cure.

[z] De la Motte Traité complet de Chirurgie, Tom. IV. pag. 435, &c.

If

If every thing be duly conſidered, and it appears that there are no ſymptoms which can render a reduction of the bones either uſeleſs or impoſſible, it muſt be then attempted. We obſerved before, that it was impracticable to reduce luxations which are of long ſtanding, becauſe generally the cavity of the joint is uſually filled with concreted juices, or a luxuriancy of the parts freed from the preſſure of the diſlocated bone. We alſo obſerved, that a cure could not be attempted, while the parts were invaded with inflammation, large tumour, or convulſions; as alſo when we perceive that theſe ſymptoms will ſoon after follow, for then prudence requires to defer the cure; in order to which, the two following particulars are neceſſary.

1. This is ſelf-evident.

2. The ligaments which connect the bones to each other, give the joints their chief ſtrength, but no luxation can happen, without theſe ligaments are either broken, or ſo much elongated, that they ſuffer the head of the bone to be diſplaced. But it was ſaid before, in the commentary on § 363. that a violent diſtenſion may ſo weaken the ſolid parts of the body, as to make them loſe much of their ſtrength, ſo that if the bones are replaced, the ligaments do not then acquire their former ſtrength, and therefore eaſily permit the joint to be diſlocated again, unleſs that is prevented by art. But how eaſily a joint may be again diſlocated after a reduction has been made, we are taught by the caſe related by the ſurgeon which we have ſo often recommended. For he[a] ingenuouſly confeſſes, that he could neither prevent the elevation of the patient's arm, nor the diſlocation of the bone the ſecond time, when he attempted to reduce the luxated humerus; and yet he reduced the bone again ſo ſpeedily, that neither the patient, nor the ſervants who aſſiſted him, could perceive his error. The cure of a luxation

[a] De la Motte Traité complet de Chirurgie, Tom. IV. pag. 347.

there-

therefore requires a retention of the reduced bones in their proper ſituations, until the ligaments have recovered their due ſtrength, ſo as to be able to perform their uſual motions without danger of being diſlocated again; for this is the main end of the cure. But the time required for the ligaments to recover their former ſtrength again, is not very exactly limited by authors: in the mean time it is certain, that more or leſs time is required according to the different magnitude of the luxation, and of the joint, and according to the different temperature of the patient, and more or leſs urgency of the ſymptoms which accompany the luxation. The magnitude of the luxation is meaſured by the diſtance of the diſplaced bone from its cavity, as we obſerved before under the preceding aphoriſm; and it is very evident, that the ligaments muſt ſuffer a greater violence, in proportion as the head of the bone is farther diſplaced from its natural cavity: whence a longer time will alſo be neceſſary to compleat the cure. Add to this, that the greater or leſs weight which the limb is to ſuſtain when in health, will alſo more or leſs protract the cure; thus a luxation of the femur and ankle require a long time of reſt, as Celſus[b] obſerves; but the joints of the fingers recover their ſtrength in four days time, as Hippocrates[c] tells us. But what a difference, in this reſpect, is made by the different conſtitution of the patient, Celſus[d] again informs us, when he ſays: *Si corpus tenue, ſi humidum eſt, ſi nervi infirmi, expeditius os reponitur; ſed & multo facilius excidit, & minus fideliter continetur. Quæ contraria his ſunt, melius continent: ſed id, quod expulſum eſt, difficulter admittunt*; "If the body is thin and moiſt, "and the ligaments are weak, the bone is more "ſpeedily reduced; but then it more eaſily ſlips out "again, and cannot be ſo ſecurely retained. Where-"as in thoſe patients who are of a contrary diſpoſi-

[b] Lib. VIII. cap. 20, & 22. pag. 555, 556.
[c] De Articulis in fine. Charter. Tom. XII. pag. 467.
[d] A. Corn. Celſ. Med. Lib. VIII. cap. 11. pag. 544.

"tion,

" tion, the bones are more ſecurely retained, but " more difficultly reduced." The like we alſo meet with in Hippocrates [e]. It is evident enough, that the number and violence of the ſymptoms often prolong the cure; but yet Hippocrates obſerves, that a ſlight inflammation following the reduction, is rather ſerviceable than prejudicial; ſince the pain then prevents the uſe of the limb, and the ligaments being kept in a ſtate of tenſion by the inflammation, retain the bone more ſecurely in its cavity. Thus he ſays [f], in the place before cited, which we likewiſe mentioned upon another occaſion § 224. numb. 3. *Qui repoſito articulo, partibus ambientibus nulla inflammatione affectis, protinus humero uti ſine dolore poſſunt, hi nulla cura ſibi opus eſſe arbitrantur. Sed Medici officium eſt præſagire contra illorum opinionem, ſi quidem his rurſus prolabitur magis, quam quorum nervi inflammatione tentantur*; " Thoſe who have the joint reduced, without any in- " flammation of the circumjacent parts, are capable " of uſing their arm immediately without pain, and " think that they have no occaſion for any farther aſ- " ſiſtance: but it is the buſineſs of the phyſician to " declare againſt their opinon, in as much as they " will be more liable to a ſecond diſlocation than thoſe " whoſe ligaments are inflamed." It can never be hurtful to ſecure the parts of the diſlocated limb, ſo that it may not be moved for a conſiderable time, provided that care is alſo taken not to let the joint grow ſtiff by too long a reſt.

At the ſame time alſo in the cure, the moſt troubleſome ſymptoms muſt be relieved by a proper diet, and ſuitable remedies, which may likewiſe prevent future ſymptoms, the chief of which are pain, inflammation, and all the bad conſequences that may from thence follow. But of theſe we treated before, and ſhall in part conſider them hereafter. But it is very apparent, that the more numerous and grievous ſymptoms are to be expected, as the diſlocated limb is

[e] De Articulis, Textu 27, 28. Charter. Tom. XII. pag. 306, 307. [f] Ibidem Textu 29. pag. 308.

larger,

larger, ſince ſuch a limb cannot be diſlocated, but by the moſt violent cauſes, and will alſo require an extenſion proportionably ſtrong to make the reduction. Hence Hippocrates [e] obſerves, that in the reduction of all joints, the patient muſt be enjoined to ſtrict abſtinence, eſpecially where the articulation is very large, and the reduction difficult; but that abſtinence is leſs neceſſary when the articulation is ſmall, and eaſily replaced.

SECT. CCCLXVIII.

THE reduction is performed, 1. by holding the patient's body firm; 2. by moving the limb ſo, that the bone may directly correſpond to its cavity; 3. by introducing it into the cavity by puſhing, turning, and ſtriking it.

1. As more or leſs extenſion is required to reduce a luxation, it is evident that it cannot be performed without pain, by the reaſons before mentioned, § 349, num. 2. It is therefore neceſſary ſo to ſecure the patient, that he may not diſturb the operator, and it is likewiſe neceſſary to prevent his whole body from moving, when the affected part is extended.

2. Galen [h] prudently adviſes, in treating of the cure of luxations in general, that it is neceſſary to replace or return the diſlocated bone the ſame way in which it was diſplaced. Therefore the conſideration of the expulſive cauſes which have preceded in every luxation, will be neceſſary, in order to return the bone from whence it was diſplaced: and then he illuſtrates the aſſertion by an inſtance of the humerus being diſlocated forward. But how uſeful this admonition will be towards a happy reduction of diſlocated bones, is ſufficiently evident; for the bone which

[e] De Articulis Textu 27, 28. Charter. Tom. XII. pag 466.
[h] Comment. 1. in Hippoc. de Art. Char. Tom. XII. pag. 204.

has

has receded from its natural place, makes itſelf a way by removing the adjacent parts, and may therefore more eaſily return by the way which it has already made, than by any other: and this more eſpecially, if the bone is diſplaced by breaking the ligaments of the articulation; for in that caſe, if the bone is not directly moved to the ſame part, it cannot return into its natural ſituation. In order to perform this, an extenſion is neceſſary to be made more or leſs ſtrong in proportion as the diſlocated joint is ſmaller or larger; which extenſion is alſo neceſſary to prevent any of the adjacent parts from being intercepted, while the head of the bone is reducing to its proper ſeat. A ſufficient extenſion may be generally made by the hands in luxations of the ſmaller joints; or in young and lax habits of body, even the ſame method may be ſufficient for the larger joints; but if a ſtronger force is required, it will be often neceſſary to make uſe of ſlings and machines. A great many beautiful obſervations are to be found in Hippocrates's book De Articulis, concerning theſe machines, to which the moderns have added others; ſee alſo what has been ſaid of them in the commentaries on § 349.

3. When the diſlocated limb is once properly extended and directed, ſo as to correſpond to its cavity, the remainder is then eaſily performed. Whence Hippocrates[a] treating of a luxation of the femur inwards, ſays: *Si bene extenſum fuerit, femoris caput è regione priſtinæ ſuæ ſedis attolletur; cumque ſic ſublatum fuerit, non facile prohiberi poterit, quominus in ſuam ſedem revertatur; ſic ut quævis impulſio & directio ſufficiat. Sed deficiunt in extenſione, idcirco majorem moleſtiam habet repoſitio*; "If the femur is rightly ex-
" tended, its head will be drawn directly over-againſt
" its priſtine or natural ſeat, and in this diſpoſition
" it will not be eaſy to prevent it from ſlipping di-
" rectly into its proper cavity or ſeat, to do which

[a] De Articulis, Charter. Tom. XII. pag. 456.

" almoſt any thruſt or direction will then ſuffice. But " if the aſſiſtants are defective in their extenſion, the " reduction will be on that account the more diffi- " cult." For the elaſticity of the ligaments, and ſtrength of the muſcles are frequently in that caſe ſufficient to return the diſlocated bone into its proper ſituation. But a knowledge of the ſtructure of the diſlocated joint will readily acquaint a ſkilful ſurgeon what is further neceſſary to be done, if the bone does not ſlip into its ſeat, after it has been reduced near to its cavity, by a due extenſion; for then a gentle twiſting, a ſtroke, or a thruſt, will be frequently ſufficient to replace the bone, while the extenſion is made by experienced ſurgeons. Thus Celſus[b], in treating on the reduction of the lower jaw, ſays, after having obſerved in what manner the patient ought to be placed and ſecured: *Ubi vehementer maxilla apprehenſa eſt, ſi una parte procidit, concutiendum mentum, & ad guttur adducendum eſt: tunc ſimul & caput adprehendendum, &, excitato mento, maxilla in ſuam ſedem compellenda, et os ejus comprimendum eſt, ſic ut omnia pene uno momento fiant*; " When the " jaw is taken hold of firmly, being diſlocated on " one ſide, the chin is to be ſtruck with a blow, and " directed back towards the throat: at the ſame time " alſo the head is to be held faſt, and by agitating " the chin, the lower jaw is to be forced into its " ſeat, preſſing upon that bone in ſuch manner, as " to perform almoſt the whole operation in a mi- " nute." When ſurgeons endeavour to reduce a luxation of the humerus, by ſuſpending the patient with his arm over a door, a ladder, *&c.* making a violent extenſion, the arm hanging downwards, the diſlocated joint then frequently returns to its ſituation in a moment. But how much it is for the ſurgeon's intereſt and ſucceſs in the cure, to be aſſiſted with ſkilful hands, eſpecially in difficult caſes, is ſufficiently apparent.

[b] Lib. VIII. cap. 12. pag. 546.

That

That the diſlocated bone is returned into its former ſituation, is generally perceived by the ſound or noiſe which it makes in the moment of its reduction: but Celſus[c] obſerves, *Quod caput humeri impulſum in ſuam ſedem, modo cum ſono, modo ſine hoc, compellatur*; "That the head of the humerus may be puſhed in-"to its ſeat, as well without a noiſe as with." But almoſt all ſurgeons have obſerved, that there is conſtantly at leaſt ſomething of an obſcure noiſe to be heard at the time of the reduction. Fabricius ab Aquapendente[d] ſeems to have been much alarmed with danger from this noiſe, imagining it to proceed from the colliſion of the head of the bone againſt the edge of its cavity, whence this laſt might be broke before the head of the bone could enter in the ſaid cavity; and therefore he thought a compleat reduction to be impracticable: he likewiſe judged the noiſe to ariſe ſometimes from the percuſſion of the head of the bone againſt its cavity or ſocket, from whence the worſt ſymptoms might be afterwards feared. But daily experience, and the obſervations of the moſt faithful ſurgeons, ſufficiently convince us, that this fear is without any foundation, ſince the noiſe is generally perceptible, and that without being followed by any of the bad conſequences which might be juſtly expected from thoſe cauſes. It was ſaid before, in the commentary on § 365. that a diſtortion or alteration in the figure of the limb, is to be reckoned among the principal diagnoſtic ſigns of a luxation, if joined with the tumour in ſome other part. When the diſlocated bones are properly reduced, it is evident that all theſe muſt again diſappear. It is likewiſe obſervable, that pain always accompanies a recent luxation, from the violent diſtraction of the ligaments, and other adjacent parts; but ſo ſoon as the joint is reduced, that pain immediately ceaſes, or at leaſt is much diminiſhed: for ſometimes a ſmall de-

[c] Lib. VIII. cap. 15. pag. 549.

[d] Chirurg. Univerſ. lib. V. cap. 1. pag. 350.

gree of pain may continue from the violent extenſion, which the circumjacent parts and ligaments of the bones have ſuffered in the reduction, though ever ſo well made; ſince alſo a very ſtrong extenſion is often required, before the reduction can be made.

SECT. CCCLXIX.

AFTER the bones are reduced to their proper ſituations, they are to be retained there by reſt, bandages, and a natural diſpoſition or poſture of the parts.

After the bones have been reduced to their proper ſituations from whence they were diſplaced, then the other part of the cure (§ 337. numb. 2.) ſtill remains; namely, to retain them in that ſituation; but this is performed

By reſt.] In every diſlocation the confining ligaments of the joint have been either broke, or very much elongated; ſo that if reſt is not ordered, the replaced bone may eaſily ſlip out again. It was demonſtrated before in § 25. numb. 3. that the ſolid parts of the body may be weakened by too great a diſtraction; and in § 28. numb. 5. it was affirmed, that the ſtrength or coheſion of the ſolids is increaſed by the long continuance of all the parts in the ſame contact, which is ſometimes carried ſo far, that they at length acquire too much ſtrength or ſtiffneſs: Reſt will be therefore always neceſſary to reſtore the ſtrength of the over ſtrained ligaments, or to procure an union of them if they are broken; but care muſt be taken not to let the ligaments become rigid by too long a reſt, nor to give occaſion for an anchyloſis to be formed by an accumulation of the mucilage of the joint, which may become inſpiſſated for want of motion. Hence it is adviſeable to gently move, and rub the joint for ſome days after it has been

been diſlocated, provided all the pains are abated, and there is no danger of an inflammation, as Hippocrates[a] carefully obſerves, in treating of the cure of a luxation in the humerus. But Celſus[b] remarks, that this caution ought more eſpecially to be obſerved in a diſlocation of the elbow, when he ſays; *Celerius tantum ſæpiuſque id reſolvendum eſt, multoque magis aqua calida fovendum, & diutius ex oleo & nitro ac ſale perfricandum. In cubito enim celerius, quam in ullo alio articulo, ſive extra remanſit, ſive intus revertit, callus circumdatur; iſque, ſi per quietem increvit, flexus illius poſtea prohibet*; "The dreſſings are to be ſpee-
" dily and often removed, the part is to be well fo-
" mented with warm water, and to be rubbed for a
" conſiderable time with oil, ſalt, and nitre. For a
" callus is ſooner formed in the cubitus than in any
" other joint, whether it remains diſplaced or redu-
" ced to its proper ſituation. And if it ſhould by
" reſt concrete, the flexibility of the joint will be af-
" terwards deſtroyed."

Beſides this, the pain or inflammation, which often continues from the violence offered to the injured parts, alſo requires the limb to be kept at reſt for ſome time after the reduction.

By bandages.] Unleſs the ligaments are quite broke, or violently ſtretched, the reduced bone may be eaſily retained in its ſituation, barely by keeping the part at reſt: ſo that bandages are not always neceſſary: Agreeable to this, we are told by a very ſkilful ſurgeon[c], that he applied no bandages after a reduction of the lower jaw, and yet the cure ſucceeded very well. But if there is any danger of a relapſe in the diſlocated joint, it may be beſt to ſecure the part with bandages; eſpecially if the preſſure of the compreſſures and other dreſſings is determined by the bandages moſtly to the affected part from

[a] De Articulis, Textu 30, 31. Charter. Tom. XII. pag. 308.
[b] Lib. VIII. cap. 16. pag. 551.
[c] De la Motte Traité complet de Chirurgie, Tom. IV. pag. 335.

whence the bone was diſplaced. This has been very well obſerved by Hippocrates [d], in treating of a luxation of the humerus, where he ſays: *His ergo mederi oportet cerato & ſpleniis, & multas faſcias circumdare: ſupponere autem axillæ lanam mollem puram convolutam, quæ cavum (axillæ) repleat, ut vinculum fulciat, & articulum ſuſtineat*; "Theſe luxations ought "therefore to be ſecured by plaiſters, compreſſes, and "the application of many bandages: but in the ax-"illa is to be fixed a piece of woollen cloth rolled "up, ſufficient to fill the cavity of the armpit, in "order to ſuſtain the joint and fill out the bandage." For by this means the head of the bone may be prevented from ſlipping out again from its ſeat into the cavity of the axilla, which, Hippocrates [e] ſays, is the only manner in which the humerus can be luxated, as far as he could ever obſerve; and therefore he has not treated of the other ſpecies of this luxation.

But it is very evident, that by knowing which way the bone has been diſplaced from its cavity, it may be prevented from ſlipping out again by the application of a bandage ſuitable to each particular luxation. But when the part has been thus ſecured by bandage, it ſhould be ſeldom opened, unleſs an inflammation ſhould attend; for then the apparatus of dreſſings are to be more frequently removed in all luxations, according to the direction of Hippocrates [f].

The natural poſture of the part.] It is evident the part affected muſt be kept at reſt a conſiderable time; but that it may be ſo retained without uneaſineſs, it will be neceſſary to place it in the ſame poſture in which we obſerve the limbs when a perſon is ſleeping, and when none of the muſcles are acting by the influence of the will: but at that time the flexor muſcles of the limb do by their contraction prevail over the

[d] De Articulis, Textu 29. Charter. Tom. XII. pag. 308.
[e] Ibid. Textu 3. pag. 290.
[f] Ibid. pag. 466, 467. in fine libri.

extenſor

extenſor muſcles; from whence it is that we obſerve almoſt all the joints a little inflected. See what has been ſaid concerning the natural ſituation of the parts in the commentary on § 349. numb. 3. Therefore Hippocrates [g] lays it down as a general rule in every luxation, *Semper quieſcere læſum articulum convenit, & quam optime figurari*; "That it will be always pro-"per to keep the injured joint at reſt, and in the "moſt convenient poſture." And hence he deſcribes the particular poſture moſt convenient for each luxation. Thus, for example, in treating of a luxation of the cubitus, he ſays [h], that the part ought to be ſo diſpoſed in the cure, that the extremity of the hand may be a little higher than the cubitus, while the arm is placed by the ſide of the body; for by that means it may be ſuſpended and carried without any uneaſineſs, and it will be likewiſe more commodious for uſe, and agreeable to nature.

All theſe particulars being duly obſerved, we may reaſonably expect an happy cure when the bone has been diſlocated by ſome external violence; but when the bone has ſlipped out of its cavity from a relaxation of its ligaments, the cure then will be much more difficult; whence Celſus [i] pronounces, *Qui nervorum vitio prolapſi ſunt, compulſi quoque in ſuas ſedes iterum excidunt*; "Thoſe joints, which are diſlocated "through a defect in their ligaments, ſlip out again, "even after they have been reduced to their proper "ſituations." The reduction of theſe luxations is indeed very eaſy, but the retention of them is very difficult, and even ſometimes quite impracticable. All the hope then in this caſe depends upon a long continued reſt of the part, with the application of ſtrengthening fomentations, which may reſtore the relaxed ligaments to their due firmneſs. Petit [k] has obſerved happy ſucceſs in theſe caſes from the application of

[g] De Articulis, Textu 29. Charter. Tom. XII. pag. 467.
[h] Ibid. pag. 331. [i] Lib. VIII. cap. 11. pag. 544.
[k] Acad. des Sciences l'an. 1722. Mem. pag. 163.

thick compreſſes dipt in aromatized ſpirit of wine, and ſpread with a mixture of powdered allum with the white of an egg ſecured all round the articulation of the femur by a convenient bandage; and he frequently applied the ſame medicine to moiſten the bandages and compreſſes without removing the apparatus. Galen tells us [1], that he has twice cured a luxation of the femur proceeding from a relaxation of the ligaments; but affirms, that the articulation ought to be inveſted for a conſiderable time with drying medicines, in order to remove the redundant humidity of the ligaments. Even Hippocrates acknowledges ſo much difficulty in the cure of theſe luxations, that he has recourſe to the laſt refuge of the art, namely to fire or cauterization. For he obſerved that many were by this accident rendered incapable of war and other exerciſes, nor did he ever know any one who rightly treated them, and therefore he is the more large in his deſcription for this method of cure. But he ſpeaks principally of that ſpecies of luxation, in which the head of the humerus ſlips into the axilla; though it is alſo very evident, that the ſame method of cure is likewiſe applicable to other luxations, both of the ſame and of other joints.

The whole deſign of the cure ſeems to conſiſt in forming a cicatrix by the actual cautery in the ſkin and panniculus adipoſus, whence the integuments are ſo much hardened as not eaſily to admit of being extended, ſo as to prevent the bone from ſlipping out again the ſame way. He orders the arm to be a little elevated, (for if it is not raiſed one cannot have free acceſs to the axilla; and if it is raiſed too much, the ſkin will be drawn ſo tight that it cannot be conveniently taken hold of) and the looſe ſkin with the panniculus adipoſus to be pulled out by the fingers, ſo that the integuments may recede a good way from the glands, large nerves, and conſiderable blood-veſſels which are there ſeated.

[1] Comment. IV. in Hippocrat. de artic. Charter. Tom. XII. pag. 453.

He

He then orders the elevated ſkin to be very ſpeedily perforated with an actual cautery, which is not thick but rather long and round; and he would have the iron to be ſo far heated as to be white or pellucid (χρὴ δὲ διαφάνεσι καίειν): then the ſkin being as yet elevated is to have a ſlender ſpatula (ὑπάλειπτρον) paſſed thro' the two apertures made by the cautery, which being done the ſkin is to be let looſe, and another perforation made by a ſlender cautery forced through the integuments till it meets with the ſubjacent ſpatula. Thus the part may be cauterized in three diſtinct places without danger of injuring the ſubjacent parts. Now during the time of the cure the eſchars will be ſeparated, and then the integuments will unite or grow to each other, but in ſuch a manner, that they will be rough and hard with the ſcars occaſioned by the loſs of ſubſtance made by the cauteries: and therefore he adviſes not to raiſe the arm much during the whole time of the cure, but only to elevate it ſo much as will be neceſſary for dreſſing the wounds; for thus the integuments not being diſtended will give an opportunity for the lips of the wounds to cohere and unite with each other the more firmly and ſtrictly. Even after the cure of the wounds, Hippocrates would have the arm tied down to the ſide for a conſiderable time, that the cicatrices may be rendered more firm and ſecure, and that ſpace contracted where the humerus uſed to prolapſe. Hippocrates has alſo pointed out two other places where cauterization may be ſerviceable in this caſe; namely on each ſide the head of the os humeri, betwixt the bone and the large tendons which form the cavity of the axilla on each ſide; namely the tendons of the pectoral muſcle and latiſſimus dorſi [m].

In like manner I remember the cure of ruptures was attempted formerly by a certain empiric, who,

[m] Hippocrat. de Articulis, Textu 41, &c. Charter. Tom. XII. pag. 312—320.

after

after returning the prolapſed inteſtines, deeply cauterized the integuments of the rupture, either with the actual or potential cautery; and this with a view, that they, being contracted with a deep cicatrix, might not ſo eaſily yield afterwards to any extenſion.

Of INFLAMMATION.

SECT. CCCLXX.

AN inflammation, which is ſometimes called a phlegmon or fire, is ſo denominated from the ſimilitude both of its cauſes and effects with thoſe of fire.

Before we proceed to treat of acute diſeaſes, it is beſt to premiſe the hiſtory of inflammation with all its conſequences, becauſe that will afford much light into the nature of thoſe diſeaſes; and the ſucceſſive changes made by an inflammation in the external parts of the body towards health or another diſeaſe, may be more diſtinctly underſtood; and from thence one may foreſee what will follow when the like diſorder invades the internal parts of the body.

General cuſtom has in all languages (as far as I can find) impoſed a name to this diſorder from that of fire. Thus it is termed *inflammatio* by the Latins, and *phlegmon* or *phlogoſis* by the Greeks. Nor need we wonder at this, ſince the greater heat, which was ever aſcribed by all people to an inflammation, is proved from phyſics to ariſe from a greater quantity of fire. Thus ſays Galen [a]; *Hic vero tumor, aſſumens pulſum & igneum ardorem, antea proprie vocatam phlegmonen perficit. Non autem ſic veteres; ſed quemcunque ardorem vocabant phlegmonen, uti ſæpius vobis demon-*

[a] Comment. 3. in Lib. Hippocrat. de Fracturis Charter. Tom. XII. pag. 236.

ſtratum

ſtratum fuit. Verum ab Eraſiſtrati temporibus ſolitum fuit, phlegmones nomen dici de illis tumoribus, in quibus non tantum eſt calor inflammans, ſed & renixus & pulſus: ex neceſſitate vero habent & ſic vocatum ruborem, &c. "But this tumor, aſſuming a pulſation and fiery "heat, anſwers then properly to the ancient title of "phlegmon. But the ancients do not thus diſtin-"guiſh it; for they called any heat or inflammation "a phlegmon, as I have frequently demonſtrated. "But from the time of Eraſiſtratus it has been cuſto-"mary to term thoſe tumors phlegmons, in which "there is not only an inflammatory heat, but alſo a "reſiſtance and pulſation; they have alſo of neceſſity "a redneſs ſo called." *&c.* And in like manner in another place[b] he mentions heat among the diagnoſtic ſigns of a phlegmon. And thus Ægineta[c] ſays, *Communiter quidem calidos omnes & dolentes cum ardore tumores phlegmonas vocare conſueverunt. Pro diverſitate vero materiæ, efficientis ipſos, horum quoque differentiam variare dicunt. Sanguine namque bono & moderatæ craſſitiei in partem aliquam confertim irruente, & ob copiam impacto, proprie dictam Phlegmonem fieri; bile flava autem in quadam parte hærente, Herpeta; ſanguine vero cum bile flava irruente, Eryſipelas. Quando vero ſanguis influens calidus admodum fuerit & craſſus, carbones parere ſolet;* "That indeed it was uſual to call "all hot tumors, accompanied with pain and burning "heat, by the name of phlegmons. But that even "theſe are ſaid to differ according to their efficient "matter. For good blood of a moderate conſiſtence "flowing plentifully and forcibly into any part, be-"ing there impacted by its quantity, occaſions the "Phlegmon properly ſo called; but yellow bile lodg-"ing in any part forms an Herpes; and blood flow-"ing together with yellow bile cauſes an Eryſipelas.

[b] De Tumoribus præter Naturam, cap. 2. Charter. Tom. VII. pag. 313.

[c] Lib. IV. cap 17. pag. 63. verſa.

"But

" But when the influent blood is very hot and thick, " it uſually produces carbuncles."

Heat was therefore a common ſign of every inflammation among the ancients, who gave the common appellation of phlegmon to all kinds of inflammation; but they afterwards reſtrained it only to that ſpecies of inflammation, in which there was a reſiſting tumour, accompanied with a redneſs and a burning heat; but to the other ſpecies of inflammation they gave different names. Thus in Celſus[a] we read, *Notæ inflammationis ſunt quatuor, rubor, & tumor, cum calore & dolore*; " That the ſigns of inflammation " are four; to wit, a redneſs, and tumor, with heat, " and pain." Whence it appears, that the general name of inflammation was even among the Latins reſtrained to only one particular ſpecies.

But that there is a greater quantity of fire in the inflamed part is demonſtrated by thermometers, and the effects being quite ſimilar to thoſe which ariſe from the application of elemental fire to the body. For when a healthy perſon applies the back of his hand to a fire, he begins to perceive a greater heat, then the part will become red; and if he applies it ſtill nearer to the fire, it will ſwell and become painful; but if he continues to approach with his hand ſtill nearer to the fire, the pain will be violently increaſed, the cuticle will be raiſed into bliſters, and at length the ſkin itſelf will be burnt up into an eſchar by the increaſed action of the fire; which eſchar being abſolutely a dead or foreign ſubſtance, muſt be ſeparated from the living parts by a ſuppuration: but the ill conſequences of an inflammation are altogether the ſame with theſe, and ariſe in the like order. For a ſlight heat, redneſs, and tumor, attended with pain, form an inflammation on the back of the hand: all which ſymptoms have increaſed in proportion to the diſorder itſelf. But from a violent inflammation tending to a gangrene, the cuticle is alſo raiſed into bliſ-

[a] Lib. III. cap. 10. pag. 139.

ters,

ters, and gangrenous eſchars are formed, which muſt be likewiſe ſeparated from the living parts by ſuppuration: and if the inflammation ſtill continues increaſing in violence, all the parts appear black even to the bone, in the ſame manner as if they were burnt by the fire; and then the part is ſaid to be mortified or ſphacelated. Hence alſo Hippocrates calls an ardent fever by the name of fire, (τὸ πῦρ) becauſe in that diſorder there is often ſo great a heat felt in the vital organs, as if there was a real fire; from whence death often enſues very ſuddenly. And in the moſt ardent fever, the plague, when the malignity of the diſtemper is tranſlated to ſome particular part of the body, it is obſerved to be burnt up in ſuch a manner, as if it was actually occaſioned by fire; as is evident in the peſtilential carbuncles, which are afterwards ſeparated and thrown off by a ſuppuration all round them; and this perfectly in the ſame manner as is uſual when any part of the body has been burnt by a red hot iron. Thus the wiſe antients did, by obſervation only of the effects of an inflammation, denominate it juſtly from fire; ſince both the cauſes and effects of each are alike: and the modern obſervations concerning the nature of fire are a ſtrong confirmation of all that has been here ſaid.

SECT. CCCLXXI.

AND it conſiſts in a greater preſſure and attrition of the red arterial blood, ſtagnating in the ſmalleſt veſſels, and urged by the motion of the reſt of the blood, which is more forcibly agitated by a fever.

In this aphoriſm we are furniſhed with a definition of an inflammation or phlegmon, properly ſo called from its cauſes, and denominated ſo by the ancients from its ſymptoms. For they defined a phlegmon, (as

(as is evident from what we lately cited from Galen under the preceding aphoriſm,) that it is a preternatural tumour, hard and reſiſting, with redneſs, heat, and a pricking pain, accompanied generally with a fever. But it muſt be obſerved, that this definition here given relates only to the inflammation ſo far as it extends to thoſe veſſels, which naturally contain red blood, or which at leaſt may by dilatation admit the blood. But as for what relates to this diſorder, when it is ſeated in the moſt ſlender or lymphatic veſſels, we ſhall treat hereafter at § 379, 380. This being premiſed, we may be able to explain the definition above given.

In this diſorder there are two concurring cauſes, which together conſtitute the nature or exiſtence of inflammation; namely obſtruction, with an increaſed velocity of the blood flowing into the obſtructed veſſels. For the blood ſtagnates in an inflammation, and cannot paſs through the ſmalleſt veſſels, even though it be urged forward by the impulſe of the ſucceeding blood; there is therefore an obſtruction of the veſſels denying a paſſage to the humours which they ought to tranſmit. But it is evident from what has been ſaid on § 107. that an obſtruction is formed whenever this paſſage or tranſmiſſion of the humours through the veſſels is cut off. The obſtructing matter is the red blood of the arteries; becauſe it is in the arteries only, that an obſtruction, properly ſpeaking, can take place, as we demonſtrated in the commentary on § 119. But the parts of the veſſels obſtructed are their ſmalleſt branches and extremities, ſince it is evident, that the obſtructing particles may be as yet able to paſs through the larger veſſels; but then they will be ſtopped towards the ends of the ſmaller converging veſſels. But we do not here underſtand the ſmalleſt veſſels of all in the body, but only the ſmalleſt branches of the largeſt; thoſe namely which contain the groſſeſt part of the humours, the red blood. So that theſe veſſels may be called

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the ſmalleſt with reſpect to the largeſt of their own genus, but with reſpect to thoſe which are ſtill ſmaller, even theſe may be termed large: for the ultimate ends of theſe ſanguiferous arteries will be always larger than the ſerous artery which thence ariſes, and which by the ſmallneſs of its diameter naturally excludes all the red blood. Thus it alſo is in the laſt extremities of the ſerous arteries, which will for the ſame reaſon be always larger than the lymphatic artery thence ariſing, &c. Hence it is evident, that a true phlegmon is almoſt conſtantly ſeated in the ſmalleſt ſanguiferous arteries, or elſe in the ſerous arteries dilated; and therefore this is the inflammation of the firſt order, as we termed it at § 122. But when the obſtructing particles ſtagnate at the ends of the ſmaller veſſels, they will be neceſſarily compreſſed by the action of the vital humours behind; and this even with no ſmall force, ſince it is by the force of the heart and arteries that the blood flows into the obſtructed part with ſuch a velocity or impetus, as would be ſufficient to convey it through the extreme parts of the body, with a conſiderable degree of its velocity ſtill remaining; whence the preſſure muſt be great, and renewed at every contraction of the heart and arteries. (See the commentary on § 120.) But as the obſtructing particles ſeem to remain immoveable, wedged into the extremities of the ſmaller veſſels, it does not ſo readily appear from whence the attrition muſt ariſe, which ſeems to ſuppoſe the influx and return of theſe particles. But if what has been ſaid in the commentary on § 132. numb. 1. be duly conſidered, the obſtructing particles will appear to be not always immoveable or at reſt, but ſometimes repelled by the contraction of the arteries towards their larger diameter, and then again propelled forward by the force of the heart filling the arteries, and urging the blood into their ſmalleſt extremities; and from hence it is that a real attrition is here produced.

All

All that has been hitherto ſaid is alſo applicable to obſtructions in the ſmalleſt veſſels formed by a ſtagnation of the red arterial blood, and therefore it is added in the definition *more forcibly agitated by a fever*. When a violent inflammation has invaded any of the viſcera or more conſiderable parts of the body, we then always find it accompanied with a fever; but if the inflammation is ſeated in the ſmaller parts of the body, eſpecially the external, it may be then queſtioned whether a fever is always preſent; for an inflammation of the eyes, an inflammatory quinſy, *&c.* are frequently obſerved without any ſenſible alteration in the pulſe. This is very well explained by Galen[a], where he deſcribes the nature of pulſes which accompany inflammation; *Incipiente enim inflammatione pulſus major eſt, quam ſecundum naturam, & vehementior, & celerior, & crebrior. Aucta inflammatione omnia hæc increſcunt, & manifeſte durior ſit, &c.* "For at the beginning of the inflammation the "pulſe is larger, ſtronger, ſwifter, and more frequent "than according to nature. But when the inflammation is increaſed, the pulſe is alſo increaſed in "theſe reſpects, and becomes manifeſtly harder," *&c.* And a little afterwards he adds, *Hæc inflammatio habet, quæ pulſum per totum corpus immutat, ſive ob magnitudinem, ſive ob principem partem, in qua conſiſtit. Si vero univerſum corpus non afficiat, pulſus in parte inflammata talis erit, qualem diximus*; "This inflammation has ſomething in it which changes the pulſe "throughout the whole body, either from the magnitude of it, or the importance of the part, in "which the inflammation is ſeated: but if the whole "body is not affected, the pulſe will be found thus (as "we before deſcribed it) in the inflamed part itſelf." It is therefore under this reſtriction, that we are to underſtand the aſſertion that a fever is a general companion with every inflammation, at leaſt in the

[a] De Pulſibus ad Tyrones, cap. XII. Charter. Tom. VIII. pag. 8, 9.

inflamed

inflamed part, if not in the whole body; ſince the ſtrength and quickneſs of the pulſe will be there increaſed, ſo as to occaſion as it were a fever of the part itſelf, as Galen [b] very well obſerves in another place. For after ſaying that there are a great many different ſorts of inflammations, he obſerves, that a fever uſually accompanies all of them. He then places the principal difference of inflammations in their being dry or moiſt: *Humida quidem, quæ ex calida fluxione partem obſidente fit: ſicca autem, quando ſine ulla fluxione connatum calorem accendi contingit. Hoc autem quodammodo velut febris partis ipſius eſt*; "That "the moiſt inflammation is indeed that which is "formed by a hot defluxion invading the part: but "the dry inflammation happens when the heat endeavours to inflame without any defluxion; and this "is in a manner a fever of the part itſelf." It is alſo a firm opinion of the ancient phyſicians, that an inflammation is always accompanied with an increaſed motion: for Celſus [c] in his preface, where he relates the different ſects and opinions of phyſicians, has the following paſſage: *Si ſanguis in eas venas, quæ ſpiritui accommodatæ ſunt, transfunditur, et inflammationem, quam Græci* φλεγμονὴν *nominant, excitat, eaque inflammatio talem motum efficit, qualis in febre eſt, ut Eraſiſtrato placuit*; "If blood is forced into thoſe veſſels, "which are deſtined for limph or ſpirits, it occaſions "that inflammation which the Greeks call a phlegmon, which inflammation has the ſame motion as "in a fever, according to the opinion of Eraſiſtratus." Here we are to obſerve, that he does not ſay ſimply that a fever ariſes whenever there is an inflammation, but only that there is the ſame motion attending an inflammation as attends a fever.

Hence we have a very ſalutary admonition propoſed in the practice of phyſick by Dr. Simſon [d], that

[b] De Meth. Med. ad Glaucon. Lib. II. cap. Charter. Tom. X. pag. 367. [c] pag. 5. [d] The Syſtem of the Womb, &c. by Thomas Simſon, pag. 106, 107.

the phyſician may not be deceived by imagining there is no inflammation when there is no fever. For there are often fixed pains which cauſe an inflammation of the ſtomach and inteſtines, even when no fever can be obſerved by an examination of the pulſe: and he even aſſerts, that he has ſeen baſtard pleuriſies epidemical, which would have afflicted the patient for ſeveral months without any fever, unleſs they had been treated immediately with bleeding and other remedies proper to abate inflammation.

From what has been ſaid it is alſo evident, that obſtruction has many things in common with inflammation, but that no inflammation can be conceived without an obſtruction alſo attending: beſides which, we demonſtrated in the commentary on § 120. that a violent obſtruction increaſes the velocity of thoſe juices which are to paſs through the pervious veſſels; that is, it occaſions a fever. But ſo ſoon as a fever accompanies the obſtruction, there is then an inflammation; which may be therefore termed an obſtruction with a fever, either in the whole, or only in ſome particular part of the body.

SECT. CCCLXXII.

WHICH diſorder may therefore take place, either in the extremities of the ſanguiferous, ſerous, lymphatic, or other leſſer arteries, whoſe mouths being dilated admit the red globules, or the groſs particles of ſome other fluid, incapable of paſſing through their extremities. If blood is transfuſed into thoſe veſſels, which are deſtined to lymph or ſpirits, it excites an inflammation, ſays Celſus, pag. 5.

It is therefore evident from the definition given in the preceding aphoriſm, than an inflammation or phlegmon, properly ſo called, can take place only in thoſe

thoſe veſſels which naturally contain red blood; or elſe in thoſe veſſels, whoſe orifices are ſo dilated by diſeaſe, that they admit the red part of the blood. For the particles of a fluid thinner than the red blood, being concreted from any cauſe in the other ſmaller veſſels, may alſo occaſion an obſtruction in them; and the fluid, preſſing behind the obſtructed particles may alſo occaſion a greater velocity in thoſe veſſels, without producing any redneſs in the affected part; and then the diſorder is not termed a phlegmon, but an eryſipelas or œdema callidum, *etc.* as we ſhall explain it at § 379, 380. But how far the red part of the blood may penetrate, and into what number of the decreaſing ſeries of veſſels it may enter, when their orifices are preternaturally dilated, cannot as yet be determined by experiment. In the mean time it is evident, that the red blood may not only enter by diſeaſe into the ſerous veſſels, which naturally contain yellow ſerum, as being the next coloured fluid in groſſneſs to that of the red blood; but it may alſo enter veſſels which are ſtill much ſmaller, and which naturally contain only a pellucid lymph. The white of the eye, which reſembles the brightneſs of a pearl in healthy people, becomes often ſo red by an inflammation, that one may perceive the innumerable ramifications of the veſſels, which being diſtended with red blood, are viſible enough to the naked eye; when in their natural ſtate they contained only a colourleſs fluid. I have even ſometimes obſerved, in the worſt ſpecies of the ophthalmia, that there has been a veſſel full of red blood paſſing through the very pellucid ſubſtance of the tunica cornea, conſpicuous even to the naked eye; but there is no one can doubt, but that the veſſels of the cornea, are much ſmaller than thoſe of the adnata; ſince in an healthy ſtate they are pellucid, as well as their contents. And a violent inflammation there ariſing often occaſions a red circle, viſible for a conſiderable time around the edge of the cornea, from a diſtention of the veſſels with red

blood, while there is no defect as yet apparent in the cornea itſelf; but at length the ſmall veſſels of the cornea being gradually dilated, by the violence and continuance of the diſeaſe, they may alſo admit the red part of the blood. From hence it is evident, that a true phlegmon or ſanguine inflammation may ſometimes take place even in very minute veſſels.

As to the paſſage quoted in this aphoriſm from Celſus, which we mentioned before on another account under the preceding aphoriſm; we are aſſured that the moſt antient phyſicians comprehended by the name of veins, as well thoſe veſſels which we now call arteries, as thoſe which are properly called veins. It was the opinion of Eraſiſtratus and many of his followers, that the pulſatil veins which we now call arteries, did not contain blood, but air or ſpirit, which occaſioned the pulſation in thoſe veſſels. There were even a great many of his ſect in the time of Galen who boldly maintained this aſſertion, and even promiſed to demonſtrate that the aorta itſelf did not contain any blood; but Galen [a] juſtly laughs at them, and evidently demonſtrates by experiments the falſity of their aſſertion.

So that if we interpret this paſſage of Celſus by the opinion of Eraſiſtratus, he muſt have ſuppoſed an inflammation to ariſe from the blood paſſing out of the veins into the arteries, which were judged to be naturally void of blood; that is an heſitation of the blood in other veſſels. But we, being at preſent acquainted with the circulation of the blood, know better; though even their aſſertion may be countenanced in one ſenſe; ſince an inflammation in reality ariſes, when the blood paſſes out of its proper veſſels into thoſe which naturally contain more ſubtle juices.

See more upon this head in the commentaries on § 122, where we treated of the different kinds of in-

[a] De Anatom. Adminiſt. Lib. VII. cap. 16. Charter. Tom. IV. pag. 164, &c.

flammation

flammation, as ariſing from the different diameters of the ſeveral ſeries of decreaſing veſſels.

SECT. CCCLXXIII.

THE ſeat therefore of this diſorder may be every part of the body, in which there are reticular diſtributions of ſanguiferous and lymphatic arteries.

After Ruyſch diſcovered by his injections, that in almoſt all parts of the body, the arteries were divided and diſtributed into the moſt minute branches, and that the ſmall branches ariſing from larger branches communicated with each other, and with the adjacent ſmall branches; it has from that time been cuſtomary with phyſicians to denominate theſe diſtributions of arteries, net-works (*reticulæ*) or reticular plexuſes, becauſe there are ſmall ſpaces left betwixt the branches, which unite together in the manner of a net. During the many years which that anatomiſt diligently proſecuted his injections, he often found (as we may perceive in many parts of his works) that there were intermediate ſpaces left betwixt the reticular plexuſes, which ſeemed to be deſtitute of veſſels; but by a more ſucceſsful repletion, he afterwards demonſtrated innumerable veſſels even there diſtributed, almoſt in the ſame order as he before obſerved in the larger branches. But wherever the arteries are found to divide into the ſmalleſt branches, there the particles of the blood or lymph may heſitate, being rendered impervious by concretion, or ſome alteration of their figure; or even from a diminution of the diameters of thoſe ſmall veſſels, by which they are rendered leſs capacious, the free paſſage of thoſe juices which ought naturally to flow through them, may be again impeded; and from

hence we have an obſtruction, which with an increas'd motion of the juices, (*a tergo*) behind, produces an inflammation. Now, as in almoſt all parts of the body there are ſmall branches derived from the ſanguiferous arteries, which by their minuteneſs exclude the red part of the blood, it is evident, that by a dilatation of the mouths of thoſe veſſels the red parts of the blood may miſtake their courſe, and enter the ſmaller veſſels; in the narroweſt parts of which they will ſtop and become impervious: from whence again all the like inflammatory ſymptoms may ariſe.

SECT. CCCLXXIV.

HENCE the ſeat of an inflammation may be as well ſeated in the arteries themſeves, as in the veins, nerves, membranes, muſcles, glands, bones, cartilages, and tendons, with all the viſcera; and therefore throughout almoſt every part of the body, but in no part more frequently and violently than in the fat.

Since it is evident from the modern anatomy that almoſt every part of the body contains veſſels which are capable of being demonſtrated to the eye; it is therefore apparent, that an inflammation may ariſe almoſt throughout the whole body, and eſpecially in thoſe parts which are enumerated in this aphoriſm.

Arteries and veins.] The coats of theſe veſſels are compoſed of other ſmaller veſſels, as is demonſtrable to the eye by injections, in their larger trunks. And even in animals which have been killed after a long hunting or courſing, the whole external ſuperficies of the aorta has been often obſerved to be almoſt black, from the too great diſtention of thoſe ſmall veſſels with blood, which are by an admirable intertexture diſtributed through the coats of this largeſt veſſel.

veſſel. We alſo treated of this in the commentary on § 113. numb. 2. where we enumerated a tumour of the ſmaller veſſels, ſpent in the coats of the larger, among thoſe cauſes which diminiſh the capacity of the larger veſſels.

Nerves.] The nerves may be conſidered two ways, either as they are compoſed of a tender production of the medulla of the brain, cerebellum and ſpinal marrow, or, as they are compoſed of tough membranes, or caſes furniſhed with all ſorts of veſſels. (See the comment on § 181.) In which membranous caſes, the very ſoft and pulp-like ſubſtance of the encephalon and ſpinal medulla is ſafely conveyed to all parts of the body. But whether or no thoſe extremely minute veſſels, which eſcape all our ſenſes, and compoſe the ſubſtance of the nerve properly ſo called, are at any time inflamed, is not ſo evident: but as a very thin fluid paſſes through them from the brain, cerebellum, and ſpinal medulla, as we obſerved in the commentary on § 181. it therefore ſeems reaſonable, that a diſorder of the like nature may alſo take place in theſe moſt minute veſſels. But it is evident enough, that a true inflammation may take place in thoſe larger veſſels, which are demonſtrated to the eye by anatomical injections, diſtributed throughout the conſtituent coats of the nerves.

Membranes.] For we at this time know by anatomical injections, that the moſt ſolid membranes, which the antients imagined to be altogether bloodleſs, are little more than mere intertextures of veſſels.

Muſcles and tendons.] It is evident from injections, that an infinite number of arteries are every way diſperſed through the fleſh or body of the muſcle; and we alſo know, that even the tendons, which appear ſo very white and compact of themſelves, do by anatomical injections become quite red, not only from a repletion of thoſe veſſels which are ſpent in the capſules inveſting the tendons, but alſo of thoſe veſſels which are in the ſame manner diſperſed, and run in

great numbers betwixt the fibres of the tendon itſelf. From whence it is evident, that an inflammation may be likewiſe here ſeated; and in a violent rheumatiſm the muſcles are often ſo much inflamed, that the moſt excruciating pains ariſe even from the ſlighteſt endeavour to contract them.

Glands.] Whether they be mere convolutions or bundles of veſſels, or only hollow cells diſcharging their contained juices by emiſſaries, after they have been ſecerned from the innumerable ſmall veſſels which creep upon the membrane of each cell; for the thing will be quite the ſame in both: for in both caſes the fabric of the gland is aſſerted to be compoſed of an infinite number of ſmall arteries; whence it is evident, that in theſe an inflammation may ariſe, as we are aſſured by daily obſervation in the parotid, ſubmaxillary, axillary, inguinary, and other glands.

Bones.] I believe it was ſufficiently proved in the commentaries on § 249, 252, 253. in the hiſtory of wounds of the head, that veſſels are conveyed from the perioſteum into the ſubſtance of the bone, and paſs betwixt its lamellæ; and that others enter through particular ſmall holes to the diploe of the cranium, and which in other bones extend to the medulla; and hence the ſeparation of the corrupted part, and the reproduction of what is loſt, is aſcribed to the efficacy of thoſe veſſels themſelves which are diſperſed through the ſubſtance of the bone. Therefore an inflammation may ariſe in this ſolid part, either in the arteries which run betwixt the bony lamellæ, or in the veſſels of the medulla itſelf, from whence ariſe moſt obſtinate and deep pains, a ſpina ventoſa, *&c.* as we ſhall hereafter explain, when we come to treat on the diſeaſes of the bones. Even Galen [a] has formerly obſerved, that the bones are ſometimes liable to inflammation; for after ſaying that the coats of the veſſels, with the membranes, tendons, and nerves may

[a] De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. pag. 315.

be

be inflamed, he adds: *Quamobrem oſſa quoque nonnunquam inflammatio attingit, uti et ex ipſis primo affectis aliquando prorumpit* (ὁρμᾶται.) "Wherefore an inflammation does alſo ſometimes penetrate into the "bones; and ſometimes it is extended from the "bones, when they are firſt affected." From what preceded the paſſage we have now cited, it is evident, that Galen intends that an inflammation of the incumbent parts may extend not only into the bones, but alſo that an inflammation firſt formed in the bones may be ſometimes extended from them to the other circumjacent parts.

Cartilages.] The cartilages come next in ſtructure to that of the bones, and many of them are in time converted into bones, as is apparent from oſteogeny. But as we find a vaſcular ſtructure in thoſe bones which were once cartilages, it ſeems very probable, that the like ſtructure exiſted before in thoſe cartilages: and beſides this, the diligence of anatomiſts has diſcovered and demonſtrated veſſels in the cartilages. Thus Dr. Havers [b] affirms, that he has obſerved a hundred pores in the thyroide cartilage, which admit veſſels from the perichondrium into the ſubſtance of the cartilage, and other pores which tranſmit the returning veſſels. By a happy injection of young bodies, Ruyſch [c] has obſerved blood veſſels to penetrate through the body of the patella, and to paſs in great numbers into its meditullium. And in another place [d] he confirms this, in ſaying that he can demonſtrate to the eye, that there are real blood veſſels diſtributed within the cartilages themſelves; and that he diſcovered them even in the cartilaginous ſuperficies of the head of the os femoris, and in the margins of the moveable cartilages which are placed in the articulation of the knee, betwixt the ends of the bones. But as theſe veſſels proceed from the con-

[b] De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. pag. 282. [c] Adverſar. Anat. Dec. 2. pag. 3. [d] Ibid. Dec. 3. pag. 33.

tiguous

tiguous bone into the cartilage, he was ſurprized that they extended only to about the length of two lines, and never emerged into the outer ſurface of the cartilage. From hence therefore it is evident, that an inflammation may take place as well in the cartilages as in the bones.

All the viſcera, and therefore almoſt throughout every part of the body.] That the viſcera are compoſed of veſſels wonderfully complicated or diſpoſed, and in a different manner in each particular viſcus, we are acquainted from the modern art of injection; and the acute diſeaſes of the viſcera, which we ſhall hereafter conſider, will evidently ſhew, that an inflammation with all its conſequences, a ſuppuration, gangrene, ſcirrhus, *etc.* are ſometimes obſerved in theſe; and this not without excepting the heart itſelf, notwithſtanding Pliny will have it to be the only viſcus which does not waſte by diſeaſe, nor draw any aſſiſtance from life, but being injured, cauſes inſtant death, as we obſerved in the commentary on § 304. For the pulpy ſubſtance of the heart being ſuppurated in a woman, ſhe diſcharged a purulent matter for many days by urine, and when ſhe was dead, four months after upon opening her body, an abſceſs, and ſome ſmall ſtones were found in the heart, as Hollerius [e] teſtifies. From hence it is juſtly concluded, that almoſt every part of the body is liable to inflammation, ſince it is demonſtrated from the modern anatomy, that almoſt every part of it is vaſcular.

But is in no part more frequent and obſtinate than in the fat.] We are well aſſured that the cellular membrane extends almoſt into every part of the body, and acquires different denominations, according to the different matter which it contains. For if it contains a white and hard fat in its cells, not fuſible without heat, it is then called tunica adipoſa; but when the matter contained in this membrane is ſoft and oily, it is then termed pinguedinoſa. But in thoſe parts of

[e] In Commentariis in Coac. Hippoc. pag. 824.

the

the body where this membrane is thinneſt, its cells being empty of oil or fat, eſcapes the eye, and is termed ſimply celluloſa; as, for inſtance, in the back of the hand, the forehead, *&c.* But how far this membrane extends itſelf thoughout the human body, will appear, if we conſider, that not only all the muſcles and tendons are inveſted with ſuch a cellular membrane, but that even every muſcular fibre, as far as the eye and patient hand of the moſt acute and dextrous anatomiſt has been able to penetrate, is alſo inveſted with the like cellular membrane. Almoſt every veſſel in the body runs in or through ſuch a cellular ſubſtance, which in part conſtitutes the fabric of the veſſels and viſcera themſelves. From whence it is evident, that an inflammation may frequently ariſe in this cellular or adipoſe membrane; and when it is once ſeated in this part, the inflammation uſually proves very ſtubborn; being frequently incapable of a diſcuſſion, and tends either to a ſuppuration or a gangrene. Now as the arteries which are diſperſed through this membrane, do uſually in their natural ſtate ſecern a fat oil or unctuous liniment, ſerving to lubricate the parts, for which uſe it is depoſited in the cells of this membrane, it would therefore ſeem, that theſe veſſels being dilated or broke by an inflammation, will occaſion the red part of the blood itſelf to tranſude and be accumulated in theſe cells; and from hence that hard and red tumour ſeems to ariſe, which accompanies the true phlegmon, whoſe ſeat is almoſt conſtantly in this cellular membrane only. Galen[f] has very well expreſſed this affair, in a ſentence which we quoted before upon another occaſion, in the commentary on § 118. *Quum ſanguis calidus copioſior in aliquam animalis partem procubuit, majora ejus vaſa protinus diſtenduntur, quæ plenitudinem non ferunt; ab his deinceps quæ minora ſunt. Mox ubi nec in iis ſatis continetur, exſudat foras in illa ampla ſpatia, quæ inter vaſa ſunt, ſic ut etiam omnia, quæ in com-*

[f] Method. Med. Lib. X. cap. 6. Charter. Tom. X. pag. 233.

poſita

poſita carne habentur, loca occupet; "When the hot "blood flows more plentifully into any part of the "animal, its larger veſſels will be immediately diſ-"tended, which not being able to ſupport the pleni-"tude, the blood will then flow from them into the "ſmaller veſſels. But ſoon after this, the ſmall veſ-"ſels not being ſufficient to retain it, the blood will "tranſude or eſcape into thoſe large ſpaces which lie "betwixt the veſſels, ſo as to occupy all of them, "which are in the compoſition of the fleſh." But by fleſh Galen here underſtands the adipoſe or cellular membrane, as is ſufficiently evident from what he writes in the laſt chapter of the ſame book. Beſides this, it is alſo confirmed by the event of inflammation, that the ſeat of it is moſt frequently in the cellular membrane. For if a violent inflammation be followed with a ſuppuration or a gangrene, the confined matter or gangrenous ichor is obſerved, upon perforating the ſkin, to be lodged always in the cellular membrane. Thus I ſaw, in a frightful gangrene which extended through the leg from the knee to the ends of the toes, that a large part of the panniculus adipoſus came away while the ſubjacent muſcles and tendons were quite ſound.

SECT. CCCLXXV.

THIS ſtagnation (371) is cauſed in the ſmalleſt arteries, 1. by every thing which contracts or diminiſhes the conical or cylindrical ends of the ſmall veſſels, in ſuch a manner that their diameter or opening, becomes leſs than the diameter of a blood globule; whether this be done by preſſure, diſtraction, contortion, rupture, contuſion, burning, eroſion, or ſhrinking of their membranes. To theſe add heat, violent motion, foreign bodies in the fleſh, ligatures, incumbent

incumbent weights, acrid ſubſtances, either taken as food, or applied externally, ſevere cold, too much friction, and all the cauſes of wounds, contuſions, eroſions, fractures, luxations, and obſtructions.

In the definition of an inflammation in § 371. two things were conſidered: namely, a ſtagnation of the red parts of the blood in the ſmalleſt arteries, and a preſſure or attrition from the blood preſſing behind with a greater impetus againſt that which was obſtructed. In this aphoriſm are enumerated thoſe cauſes which occaſion that ſtagnation in the ſmalleſt arteries; which yet, in their natural ſtate, are capable of tranſmitting the red part of the blood through their ſmalleſt extremities.

1. The arteries which convey the red blood, having firſt carried off the thinner parts by their lateral branches for various purpoſes, do then tranſmit the red globules (which are of a ſize too large to enter the ſmaller veſſels) from their ſmalleſt extremities into the veins, with which they form a continued veſſel. Therefore where one of theſe ſmaller arteries terminates, there the vein begins; now the artery, in its courſe, always diminiſhes gradually from a larger capacity to a leſs; but the veins are the ſmalleſt at their origin, and gradually enlarge through their whole courſe. Hence the humours paſs in the arteries from the baſis of the cone to the apex; but in the veins they paſs from the vertex towards the baſis of the cone. But in thoſe parts where the artery becomes ſmalleſt, and forms itſelf into the continued ſmalleſt veins, there the veſſel ſeems to be cylindrical, at leaſt for a ſmall ſpace, the ſides neither converging nor diverging: and if the cylindrical veſſel proceeds, either towards the artery or towards the vein, it then aſſumes the figure of an erect or an inverſed cone. But in this part where the ſanguiferous artery terminates, and the ſmalleſt vein thence ariſing begins, there

there is the ſmalleſt diameter, or the narroweſt part of the veſſel; and therefore the particles of the blood becoming impervious from any cauſe, will ſtagnate in this part. If now we again conſider, that theſe extremities of the veſſels may be contracted many ways, the juices will there ſtagnate, and be incapable of paſſing through theſe narrow anaſtomoſes. And from hence it is alſo evident, why the text contains the terms conical and cylindrical.

It was ſaid before in the commentary on § 115. that the ſmalleſt particles of the circulating humours in animals, viſible by the microſcope, appear ſpherical; and towards the laſt extremities of the veſſels only one globule has been obſerved able to paſs through at a time, and that even with ſome difficulty. From whence it is ſufficiently apparent, that the anaſtomoſes, or ſmalleſt extremities of the veſſels, being contracted or diminiſhed from any cauſe, will obſtruct the free paſſage of the humours by diminiſhing the capacity of the veſſel; ſince the bulk of the particles to be tranſmitted, does in this caſe exceed the diameters of the orifices through which they are to paſs; and therefore an obſtruction muſt conſequently ariſe, which is always an inſeparable companion of inflammation, as is evident from the definition given of it in § 107.

But ſince (as was ſaid in the commentary on § 109.) every ſection of our veſſels, which is made perpendicular to their axis, is a circle, and as that figure has the greateſt area of any that has equal ſides; it is from thence evident again, that every cauſe, which is able to change the figure of the veſſels, may occaſion a ſtagnation of the humours to be tranſmitted through the laſt extremities of the arteries. But of theſe cauſes the principal are thoſe enumerated in this aphoriſm, many of which have been explained before.

Preſſure, diſtraction, contortion.] Concerning theſe you may conſult what has been ſaid in the commentaries on § 112. numb. 1, 2, 3.

Rupture.]

Rupture.] The orifices of divided veſſels naturally contract and obſtruct the free courſe of the juices, which ought to flow through them, as was demonſtrated in the commentaries on § 158, and 159. numb. 2 and 4. and it is alſo evident from what was there ſaid on numb. 5. that a true inflammation may follow from that cauſe.

Contuſion.] Since the idea of contuſion includes an aſſemblage of ſmall wounds, as was ſaid on § 322. it is therefore evident from thence, why a ſtagnation of the humours is that way occaſioned. Add to this, that a contuſion always reſults from the preſſure of ſome hard and obtuſe body injuring the ſolid parts, which cannot be done without compreſſing or changing the figure of the veſſels.

By burning, eroſion, ſhrinking, &c.] For by all theſe ways a part is either totally deſtroyed, as by the action of fire or ſtrong cauſtics, whence the living veſſels in the margin of the diſorder are obſtructed; whence a ſtagnation and inflammation follow: or if the action of theſe cauſes is milder, by a contraction of the ſolids and an inſpiſſation of the fluids, many of the veſſels will be rendered impervious; from whence again the ſame diſorders will ariſe, as we ſhall hereafter explain more at large when we come to treat of burns.

Heat.] That is when the degree of it much exceeds the heat of a perſon in health. But we ſhall hereafter demonſtrate, when we come to treat of an increaſed heat as a ſymptom of fevers, § 689. that the ſolid fibres are therefore dried, contracted, and made rigid; but then the rigidity of the fibres, being increaſed, will augment the contractile power of the veſſels which they compoſe, whence their capacities will be diminiſhed, and an obſtruction thence formed, as was demonſtrated in the commentaries on § 113. If now it be alſo conſidered, that too great heat evaporates the moſt ſubtile parts of the fluids; and that after this the blood and its ſerum concrete

into

into ſolid maſſes, hardly capable of being again diſſolved; it will be from thence ſufficiently apparent, that an increaſed heat is juſtly reckoned among the cauſes of inflammation.

Violent motion.] Conſult what has been ſaid in the commentaries on § 100. where it was proved, than an obſtruction, inflammation, and all their conſequences, may ariſe barely from an increaſed motion.

Foreign bodies in the fleſh.] When any ſharp pointed body is fixed in the fleſh, it injures the veſſels, and compreſſes thoſe which are adjacent, while at the ſame time it cauſes a continual pain and irritation; from hence it is eaſily apparent, that an inflammation muſt from thence ariſe, eſpecially when it is fixed in parts that are very ſenſible; for then the ſymptoms are ſeldom removed, till the injurious body is diſcharged by a ſuppuration made by nature. Ruyſch * gives us a remarkable inſtance of this kind in a girl, who ſwallowed a needle unknown to her parents; after which a hard inflammatory tumour was formed in the groin, accompanied with a violent fever and intenſe pain. This tumour was brought to ſuppuration by the application of emollient cataplaſms, and being opened with a lancet, the needle was diſcharged ruſty, with a conſiderable quantity of matter mixed with ſome of the inteſtinal fœces. This dangerous diſorder was yet happily cured. But there are many obſervations, which teach us, that needles and other ſuch ſharp-pointed bodies may lie dormant for a conſiderable time in the panniculus adipoſus without giving any great uneaſineſs. Thus I knew a turner, who had ſix years before a ſplinter of wood ran into the fleſh betwixt his thumb and fore-finger; where it continued, and might eaſily be felt for ſo long a time without giving any great uneaſineſs or diſturbance to him in his daily labour; and therefore he would never ſuffer it to be extracted by a ſurgeon, who notwithſtanding told him the ill conſequences that might

* Obſervat. Anatom. Chirug. n°. 55.

follow.

follow. I likewiſe ſaw another inſtance which proves the ſame thing. A girl complained of a pricking pain about the arm: after a diligent examination of the part, I could not find any thing amiſs, even by handling it all over; and ſhe particularly obſerved, that the pain did not always trouble her, but only in ſome certain motions. I ordered the application of a galbanum plaiſter, and viſited her again ſome days after: but as ſhe found no relief from thence, in making a ſecond and more diligent examination of the part, I felt ſomething prick my finger, and afterwards perceived the ſharp point of the needle ſticking out through the injured ſkin. I extracted the needle with its thread, which was ſix inches long, by a pair of forceps; and then ſhe preſently recollected, that about ſix weeks before ſhe had loſt that needle while ſhe was intent upon her work.

Ligatures.] Theſe diminiſh the capacity of the veſſels by compreſſion; but they act more upon the veins than the arteries: ſince the former have their coats much weaker; and they likewiſe act more upon thoſe veins which are placed in the ſurface of the body. But when ligatures are drawn very tight, they then compreſs the arteries as well as the veins. This is evident in the daily performance of phlebotomy; where, if the ligature is moderately tight, the blood runs freely from the inciſed vein: but if the ligature is drawn too tight, it compreſſes the artery likewiſe, and therefore little or no blood follows; but when the ſurgeon perceives this, he ſlackens the ligature, and by that means promotes the efflux of the blood. See what has been ſaid in the commentary on § 112. numb. 4. where we alſo gave a reaſon, why incumbent weights produce obſtructions by compreſſing the veſſels externally.

Acrid ſubſtances, either taken as food, or applied externally.] It ſeems to be a property of almoſt all parts of our body, whether external or internal, to contract themſelves upon the application of any thing

acrimonious; and there are many experiments which prove the ſame thing. If a little drop of vinegar is ſprinkled into the eye, the eye-lids are ſo ſtrongly contracted, even againſt the perſon's inclination, that they require more than a ſmall force to open them. And acrid poiſons, taken into the ſtomach and inteſtines, occaſion violent contractions in them; from whence, with the confined and heated air, great inflations ariſe. Upon applying a ſmall drop of oil of vitriol with a probe to the naked inteſtine of a dog, I obſerved it immediately contract in the ſame manner, as if it was conſtringed by tying a ligature round it. It is therefore probable, that if acrid ſubſtances reach to the ſmaller veſſels, they will likewiſe be brought into the ſame contractions, from whence follows an obſtruction, which, joined with an increaſed circulation of the blood, may produce an inflammation. Thus when the blood itſelf is infected with an acid acrimony, it is obſerved to produce itchings, obſtructions, puſtules, and little ulcers about the cutaneous veſſels, as was ſaid at § 64. When the ſtagnating ſerum, which diſtends the legs of dropſical patients, begins to turn acrid, the ſkin is often inflamed. But if the force of the acrid ſubſtance is ſo great, eſpecially when externally applied, as to diſſolve the continuity of the veſſels, it is ſufficiently evident, from what has been before ſaid, that then the inflammation may be produced in a much greater degree.

Severe cold.] It is evident from experience, that cold contracts the dimenſions of all ſolid bodies; and therefore it muſt contract the capacity of the veſſels. It was alſo proved in the commentary on § 117. that the particles of the blood cohere together by cold; and therefore by both theſe effects, cold may produce an obſtruction and inflammation, and that in ſo great a degree, as to be often followed with a gangrene in a very little time, as we ſhall declare hereafter at § 454, 455. From hence too the reaſon may perhaps appear, why a pleuriſy ſo frequently follows, when

when huſbandmen indiſcreetly expoſe themſelves to the cold air when they return ſweating from their labour: for the inſpired and cold air comes almoſt into contact with the intercoſtal veſſels, while only the very thin membrane of the pulmonary veſicles is interpoſed betwixt them; and at the ſame time the cold air increaſes the diſorder externally, by being freely admitted to the body, which is not well covered.

Too much friction.] Of what efficacy friction is, in removing obſtructions, was ſaid before in the commentary on § 133. numb. 3. But when the friction has been continued too violently or too long a time, it may produce an ardent fever, even in the moſt cold and dropſical habits; as we explained it before in the commentary on § 28. numb. 2. For the motion or return of the venal blood being thus accelerated, the heart will contract more ſtrongly and frequently, whence an increaſed motion of the circulation; which being too much increaſed produces an inflammation, as we demonſtrated in the commentary on § 100. Thus we obſerve, that violent frictions make the parts of our bodies grow hot, red, ſwelled, and painful; but all theſe are the true ſigns of a preſent phlegmon, which will indeed ſoon go off if the friction is not continued too long, nor in too violent a degree: for when ſailors on board a ſhip ſuddenly let the ropes run through their hands to ſlacken the ſails againſt the wind, if they graſp them too firmly, a moſt violent attrition, heat, and pain thence ariſes in a moment, ſo as to raiſe the cuticle into bliſters like thoſe of a gangrene. If now we alſo conſider, that by frictions the red part of the blood may be drove into many of the ſmaller veſſels, into which it never enters in a natural ſtate, (as is evident from the redneſs which accompanies almoſt every friction,) it will be ſtill more evident, how an inflammation may be produced by too much friction.

All the cauſes of wounds, contuſions, *etc.*] Concerning

cerning all theſe we have ſufficiently treated before under thoſe reſpective diſorders.

SECT. CCCLXXVI.

THE ſame ſtagnation is alſo produced, 2. by every thing which occludes the paſſage of the veſſels, and applies an acrimony to them at the ſame time, whether externally or internally; ſuch as ſubſtances which are both oily and ſaline, acrid, *&c.*

We know for certain, that the whole ſurface of the body, both external and internal, is perſpirable; that is, a very thin vapour is expelled every moment of life through the ſmalleſt arterial ducts which open outwards; which vapour being condenſed upon the poliſhed ſurface of a cold looking-glaſs, or any other metalline body, forms a thin water, which afterwards entirely exhales without leaving any fœces. If now theſe ducts are by any cauſe obſtructed, as through them the perſpirable and very thin vapour ought to be expelled, thoſe very minute veſſels will be therefore dilated by the impulſe of the confined humour; and being thus dilated, they may admit groſſer juices, from whence an obſtruction and ſtagnation conſequently follow. But the leaſt exhaling veſſels being thus obſtructed, thoſe which are next in magnitude to them, not being able to diſcharge the thinneſt part of their fluid into the exhaling veſſels as before, they will be alſo dilated; and thus the diſorder will be propagated from the ſmalleſt exhaling veſſels even to the groſs blood-veſſels.

But as this exhaling vapour reſembles water almoſt in every reſpect; and as oil prevents the entrance of water into very minute glaſs tubes, or at leaſt renders the entrance of it more difficult, this may therefore be the reaſon why inflammations and an eryſipelas ſo frequently

frequently ariſe from the external application of oil. Thus we read, that the bodies of the athletæ or champions were anointed with oil, that they might not be too much exhauſted by ſweat: and after bathing it was cuſtomary to uſe unction, to prevent the moiſture from evaporating which had been acquired in the bath, and to prevent the native heat from eſcaping through the pores, which had been ſet open by the warm bath [a]. In many people the ſkin itſelf is immediately inflamed by the application of a fat or oily unguent or emplaiſter: and ſomething of the ſame nature ſeems to take place in the internal parts, ſince many people are inflamed or feveriſh ſoon after the taking of oily ſubſtances, and eſpecially lard. If now theſe oily or fat ſubſtances alſo contain an acrimony, very obſtinate inflammations may thence ariſe. Oil of almonds, which is ſo mild or ſweet when it has been lately expreſſed, does by the ſummer's heat grow rancid in a few days time, and at length acquires ſo great an acrimony, that it inflames the fauces, though ſwallowed in but a very ſmall quantity. The ſame is alſo true with reſpect to butter, which becomes rank either by long keeping or by frying in a pan. But an acrimony mixed with an oil or fat is the more prejudicial, becauſe it moſt firmly adheres to the part to which it is applied, nor can it eaſily be waſhed off by watery liquors. The berries of the ſpurge laurel of the ſhops, (*Thymelææ lauri folio ſemper virente fructus,*) being preſſed by the fingers, diſcharge a mere oil, which at firſt deceives the palate with a mild taſte, but ſoon after it ſo much inflames the fauces, that when I unwarily taſted it, it almoſt ſuffocated me, inſomuch that I was not able entirely to remove its troubleſome acrimony, even by waſhing my mouth continually with a mixture of water, vinegar, and honey for the ſpace of two whole hours. Thus alſo thoſe cauſtic and empyreumatic oils, which are obtained by an intenſe fire from hartſhorn, lig-

[a] Hier. Mercur. de arte Gymnaſtica, Lib. I. cap. 8. pag. 36, 37.

num guaiacum, and the like, (which are often recommended for the cure of ſtiff joints and for diſperſing impacted matter,) being imprudently applied to the ſkin, have been obſerved to occaſion the moſt malignant inflammations, and ſometimes even to produce a gangrene. For in theſe we find the greateſt tenacity of oils, which obſtructs the pores and ſmall veſſels: and this alſo combined with a violent acrimony, by which the irritated veſſels are contracted.

SECT. CCCLXXVII.

3. EVERY thing which cauſes the blood to concrete or cohere together; ſuch as too great motion, a conſumption of the thinner parts of the blood, by ſweats, urine, ſpitting, or a diarrhœa; to which add every thing that coagulates the blood,

It was ſaid in the hiſtory of obſtruction, that it aroſe from the exceſs of the bulk of the tranſient matter above the capacity of the tranſmitting veſſel; and that therefore the general cauſes were too great a narrowneſs of the veſſels, or an increaſe of bulk in the particles of the fluid to be tranſmitted, or laſtly from a combination of thoſe two cauſes acting at one and the ſame time. In the two preceding aphoriſms we conſidered the cauſes producing a ſtagnation in the ſmalleſt ſanguiferous arteries, ſo far as it aroſe from a contraction of the veſſels: but in this place we are to treat of thoſe cauſes which make the blood cohere or run into ſuch groſs particles, that it cannot paſs through the narrow extremities of the ſmaller arteries, even though their diameters or capacities remain the ſame. But among theſe cauſes the principal are,

Too great motion.] In the commentary on § 109 where we treated of the effects which follow from an increaſed

increaſed motion or circulation of the blood, as a cauſe, it was demonſtrated that the blood acquired ſuch a diſpoſition by this increaſed motion, as rendered it more apt to concrete. For in the blood there is always a tendency towards concretion, which is the ſtronger, in proportion to the ſtronger action of the veſſels upon their contained blood. For the blood of ſtrong men taken from a vein immediately congeals, and after ſtanding a while at reſt, exhibits much cruor or craſſamentum, and but little ſerum: the contrary of all which we obſerve in the blood of a weak girl. But all this depends on the more or leſs powerful action of the veſſels upon their contained blood. But by an increaſed motion, the action of the veſſels in a given time is more frequently and ſtrongly repeated upon the contained fluids, by which means they acquire a greater condenſation or compactneſs. Beſides this, by an increaſed motion the moſt fluid parts are diſſipated; becauſe a greater quantity of blood is applied in a given time to the organs which from thence ſeparate and diſcharge the thinner juices: and from hence again the tendency of the blood to concretion will be augmented. Add to this, that an increaſed motion is followed by an increaſe of heat; from whence likewiſe the blood may be ſo inſpiſſated, that it can be no longer able to paſs through the narrow extremities of the ſmaller arteries. And therefore in acute diſeaſes, when the heat is much increaſed, the injured function of the brain and the difficulty of reſpiration, immediately denote that there is ſuch an inſpiſſation of the blood that it can no longer paſs freely through the narroweſt paſſages of the ſmaller arteries in theſe viſcera.

A conſumption of the thinner parts of the blood by ſweats.] We are taught by obſervation (as we mentioned before in the commentary on § 93.) that the groſſeſt particles in the human blood are the red globules; but that there are a great many ſorts of thinner juices interpoſed, by which the mutual contact and

coheſion of the larger globules to each other, are impeded. So ſoon, therefore, as this more thin and fluid part of the blood is drawn off by any cauſe, the larger globules will then come into contact, and being moſt ſtrongly preſſed together at the ends of the ſmaller arteries, they will there combine or concrete; from whence a ſtagnation of them, and an obſtruction of the veſſels follow. Thus when night ſweats begin to waſte a conſumptive patient, the impervious blood begins to heſitate in the ſmall veſſels of the ſkin, and occaſions inflammatory puſtules. And for this reaſon it is that Hippocrates condemns ſweats in the beginning of acute diſeaſes: and Sydenham has obſerved their pernicious conſequence when the patient has profuſe ſweats in the beginning of the ſmall-pox.

Urine.] In hyſterical and hypochondriacal diſorders, there is often an incredible quantity of urine diſcharged, almoſt as thin as water, eſpecially when the mind has been diſturbed by any violent affection; but the blood being thus deprived of its diluting vehicle, its groſſer parts begin to concrete, and ſometimes occaſions very malignant inflammations; or elſe the craſſamentum of the blood is depoſited about the abdominal viſcera, where it uſually produces the moſt obſtinate obſtructions. And from hence ſo often ariſes thoſe hyſterical or hypochondriacal paſſions, which are aſcribed to the atra bilis.

Spitting.] If we examine the ſaliva which naturally flows from the mouth of a perſon in health, it appears ſufficiently thin, (for the mucus of the fauces and adjacent parts being mixed with the ſaliva by the motion of the tongue, renders it more tenacious;) and by chemical analyſis it appears to conſiſt almoſt intirely of water; for out of ſixty ounces of ſaliva, there may be almoſt fifty nine ounces drawn over by a gentle fire, which reſemble water in all reſpects. The ſaliva alſo does not concrete with the heat of boiling water; from whence it appears to be thinner than the ſerum of the blood. A copious diſcharge by

ſpit-

ſpitting will therefore drain off a great part of the thinner juices in the body, which the blood being deprived of, is by that means rendered leſs pervious or fluid. And for this reaſon, thoſe who by an ill cuſtom, or an abuſe of tobacco, daily throw away large quantities of their ſaliva, are ſo frequently afflicted with the worſt kinds of obſtructions in their abdominal viſcera. After all the internal parts of the mouth have been a long time covered with thick aphthæ, when they fall off, an incredible quantity of ſaliva is diſcharged from the dilated veſſels: inſomuch that if the immoderate flux or ſpitting is not removed by proper remedies, the patient is often exhauſted and killed, or elſe afflicted with chronical diſeaſes for a long time afterwards; becauſe the blood being thus deprived of its more fluid parts, produces incorrigible obſtructions; nor is it any objection againſt us, that the blood does not become inſpiſſated by a continual diſcharge of ſaliva in great quantities, continued often for ſeveral weeks together in a mercurial ſalivation: for in this caſe there is not a diſcharge of the ſaliva properly ſo called, but all the humours of the body, being diſſolved into a putrid water by the action of the mercury, are this way evacuated: ſo that in this caſe the blood is not deprived of its moſt fluid parts, while the groſſer parts are left behind; but even the red part of the blood itſelf undergoes a true diſſolution; and therefore the patient may very well ſupport this diſcharge, if the freſh juices of good aliments continually ſupply the place of the diſcharged humours.

Diarrhœas.] For this way likewiſe the thinner parts of the blood may be diſcharged from the body, as is ſufficiently evident. Therefore Hippocrates in his Prænotiones Coacæ, pronounces a profuſe diarrhœa to be fatal in an ardent fever: for ſince in this diſeaſe the blood begins to be impervious in the ſmaller arteries, by diſcharging the thinner parts of the juices, in a flux the diſorder will be rendered incurable.

Which

Which coagulate.] Concerning theſe you may conſult what has been ſaid in the commentary on § 117.

SECT. CCCLXXVIII.

THE like diſorder is occaſioned in the lymphatic arteries, 1. by all cauſes which dilate their orifices wide enough to admit the groſſer parts of the blood, which being drove further into theſe veſſels, are ſtopped againſt their converging ſides, and then the ſame conſequences follow here as we explained before in § 377. that is, there will be dilatation of the veſſel towards its origin, and a violent motion of the arterial humour behind the obſtruction. 2. by all the cauſes which are commonly productive of other inflammations (375, 376.)

Hitherto we have conſidered thoſe cauſes which obſtruct the free courſe of the groſs or red part of the blood through the ſmalleſt ſanguiferous arteries: which cauſes acted either by diminiſhing the capacity of the veſſels, or by rendering the blood itſelf impervious. But beſides this, we alſo obſerve a true ſanguine or red inflammation in thoſe veſſels which naturally exclude the red parts of the blood, by the ſmalleſt of their diameters. Of this we have a notable inſtance in the ophthalmia, in which the whole tunica adnata or white of the eye, and even the cornea itſelf look red, by a diſtention of their ſmall veſſels with the red part of the blood, to ſuch a degree that they become viſible to the naked eye, whereas naturally there was no red blood contained in thoſe veſſels. Such an inflammation muſt therefore have been preceded by certain cauſes, which put theſe dilated veſſels in a condition to receive the red parts of

of the blood. Now it is evident, that the red parts of the blood being once entered into theſe ſmaller veſſels, muſt produce an obſtruction; ſince it will continually ſtop againſt the narrower ſides of theſe converging veſſels; from whence an obſtruction ariſes, even tho' the capacity of the veſſel remains the ſame, and the particles of the fluid which ought to be tranſmitted are not at all augmented. And this diſorder is properly enough termed an obſtruction (*per errorem loci*) by the blood miſtaking its courſe; ſince in this caſe the red part of the blood ſtagnates, having entered the ſmaller pellucid veſſels, and not being capable of paſſing through their ſmalleſt extremities; ſo that the whole eſſence of the diſorder conſiſts in the red blood eſcaping into other veſſels. See concerning this what has been ſaid in the commentary on § 118, where it was alſo proved, that this diſorder may take place in every part of the body, in which there are veſſels carrying a fluid thinner than the blood derived from the ſanguiferous arteries. This diſorder therefore, or error of place, can never be ſeated in the blood veſſels, ſince we never obſerved any particles in healthy blood of a larger magnitude than that of the red globules; but it may take place in the ſeveral ſeries of the other decreaſing veſſels. But how far this red part of the blood may penetrate into thoſe veſſels, is not as yet aſcertained by experiment; but this we know, that in many diſeaſes it often paſſes into veſſels which are much ſmaller than thoſe which contain the ſerum of the blood; as will appear evidently enough, if we conſider, that it ſometimes enters even the ſmall veſſels of the tunica cornea of the eye. But ſince all that fluid which is thinner than the red and ſerous globules of the blood, is generally denominated lymph; therefore thoſe veſſels through which the thinner fluid paſſes, are alſo termed lymphatics; and theſe are either arteries or veins. But it was proved in the commentary on § 119. that an obſtruction cannot be ſeated in the veins, unleſs the

courſe

courſe of their fluids is intercepted by an external compreſſion; and therefore the groſſer particles of the blood can form obſtructions by an error of place in the lymphatic arteries only; under which name we include all arteries which admit fluids whoſe particles are ſmaller than thoſe of the red and ſerous globules of the blood, refuſing entrance to theſe laſt.

Therefore in order to form this diſorder by an error of place, it is required for the mouths of the lymphatick arteries to be ſo far dilated that they may admit the red part of the blood. But it was demonſtrated in the commentary on § 26. that the amplitude or capacity of the veſſels depended on two different cauſes; namely, the reſiſtance of their ſides, and the momentum or force of the impelled fluid; and that therefore it was to be eſtimated in a ratio compounded of the impuſe of the fluid directly, and of the reſiſtance of their ſides inverſly. If therefore a greater laxity ſhould from any cauſe ariſe in the beginning of the lymphatic arteries, the force of the impelled fluid remaining the ſame, they will be dilated; and on the other hand, the impulſe of the fluids being increaſed, while the reſiſtance of the ſides of thoſe veſſels remains the ſame, it will produce the like effect; but this more eſpecially when both theſe cauſes concur at the ſame time. See what has been ſaid concerning the laxity of the veſſels, as a cauſe of the blood's miſtaking its courſe, in the commentary on § 118. But why the orifices of the veſſels are dilated by an increaſed motion of the arterial fluid, was explained in the commentary on § 100. But what has been now ſaid, is alſo confirmed by experiments; for any part of the body being expoſed to the vapours of warm water, will ſwell and look redder than uſual, from the ingreſs of the red blood into the ſmaller relaxed veſſels. And after violent running, we ſee that the whole external ſkin looks red, and the eyes are in a manner ſuffuſed with blood from the entrance of that fluid into the ſmaller pellucid

pellucid veſſels, which are dilated by the greater impulſe communicated to the fluids.

2. When once the red blood is entered into a lymphatic veſſel, it is evident enough, that all thoſe cauſes which are capable of diminiſhing the capacity of the larger or ſanguiferous arteries, may produce the ſame effects, when applied to theſe ſmaller ateries. But of theſe we treated in the two aphoriſms here cited.

SECT. CCCLXXIX.

HENCE we ſee that the ſame diſorder may take place in every conical veſſel, in which the humours flow from a larger to a leſs capacity; for as in the red blood, ſo in the lymph, there are probably many parts groſſer than the reſt.

In healthy blood, which has been lately drawn from a ſmall wound, and viewed by a microſcope in capillary glaſs tubes, we diſtinguiſh ſeveral ſorts of particles; and the ſame we are likewiſe able to diſcern in the pellucid membranes of living animals, in which the circulation of the humours through the veſſels may be ſeen. For here we perceive globules ſwimming in a thinner pellucid fluid, in which laſt we can diſcover nothing farther, becauſe the pellucidity makes the fluid appear homogeneous. But it ſeems highly probable, that in the thin or pellucid lymph of the blood, there are alſo ſome parts groſſer than others, which by their determinate magnitudes, are contained in proportionable veſſels, into ſmaller than which they cannot naturally enter. For unleſs the red globules were ſo large as to prevent them (in an healthy ſtate) from entering the ſerous and ſmaller veſſels; it is evident that all the blood would be derived into the ſmaller veſſels, while the larger veſſels

veſſels would remain quite empty. The ſame is alſo true in thoſe veſſels which convey the ſerum of the blood, and in the ſeveral ſeries of the ſmaller veſſels. From hence when the blood becomes too fluid in diſeaſes, it is either exhaled, or diſcharged out of the body by the emunctories, or is accumulated in the larger or ſmaller cavities of the body, as we obſerve in dropſies; but then the larger veſſels always collapſe for want of a ſufficient quantity of the thicker part of the blood which uſed to diſtend them. Now the ſame thing ſeems to be true in the other decreaſing ſeries of the veſſels, from the largeſt ſanguiferous, down to the moſt minute exhaling ones; that is to ſay, every ſeries of veſſels have their proper and reſpective fluids, which are compoſed of ſuch groſs particles, that they cannot enter into the ſmaller veſſels of the next ſucceeding order, but are confined each to their reſpective veſſels. This being premiſed, if the capacity of theſe converging veſſels is by any cauſe diminiſhed, or the particles combined, which uſed to paſs through the narrow extremities of thoſe veſſels, an inflammation may follow; but not a red one, as being ſeated in the ſmalleſt and pellucid veſſels. Add to this, that if the orifices of the ſmall veſſels of the next ſucceeding order, are by a relaxation, or too violent a motion, ſo dilated as to admit the groſſer particles of the next larger ſeries of veſſels, it muſt produce the like ſpecies of diſorder (*ab errore loci*) by miſtaking their place. There may be therefore as many different kinds of inflammations as there are different ſeries of veſſels, interpoſed betwixt thoſe which are the largeſt and the ſmalleſt in the body; and they may be there produced two ways, either from a narrowneſs of the veſſels, and an impervioufneſs of the fluids, from the largeneſs of their particles or elſe by an error of place, when the groſſer particles, paſs out of the larger veſſels in the dilated orifices of the ſmaller veſſels. But in the largeſt or ſanguiferous veſſels, an

an inflammation can never be produced by an error of place, ſince there are no particles found in the blood groſſer than thoſe of the red globules. Whether or no the rheumatiſm, and gout of the joints and feet, ariſe from an inflammation of the ſmaller veſſels, is a queſtion concerning which you may conſult what has been ſaid in the commentary on § 122.

SECT. CCCLXXX.

FROM hence the true difference betwixt a phlegmon, eryſipelas, œdema, and a ſcirrhus with an inflammation, is ſufficiently apparent.

Phlegmon.] Though the antients uſed this name for any kind of inflammation, yet it was afterwards cuſtomary (as we ſaid in the commentary on § 370. from the authority of Galen, and Ægineta) to apply this term only to a preternatural tumour accompanied with redneſs, reſiſtance, heat, pulſation, and pain in ſome ſoft part, with a fever attending either in the whole body, or in the part itſelf. But this is occaſioned from a ſtagnation of the red blood about the extremities of the arteries, whilſt the reſt of the blood acts with a greater impulſe from the force of the heart and arteries, urging it forward behind the obſtructions. A phlegmon may therefore ariſe either in the ſmalleſt extremities of the ſanguiferous arteries, or, which is more frequent, it may be produced by an infraction of the red blood into the ſerous or lymphatic arteries by an error of place. But it is evident by what has been ſaid in the commentary on § 371. that the ſeat of a true phlegmon is moſt frequently in the adipoſe membrane.

Eryſipelas.]

Eryſipelas.] Galen [c] defines an eryſipelas in ſuch a manner, that it would ſeem entirely to reſemble a true phlegmon; for he ſays, *Si ex ſanguine et flava bile juſto calidioribus fluxio miſta fuerit, aut ex ſanguine quidem, ſed fervido, at ſubſtantia tenuiſſimo, eryſipelas vocatur ille affectus, multo calidior inflammatione, et aſpectu flavior. Et ſi tetigeris, ſanguis facile ſubfugit, rurſuſque affluit, exquiſite tenuis et ruber apparens. Non tamen ſimiliter dolet eryſipelas ac inflammatio: neque ſecundum ullam inflammationis ſpeciem aut pulſum, aut compreſſionem, aut diſtenſionem ſimilem adfert. Verum aliquando moderate omnino infeſtat, et maxime, quando circa ſolam cutim diſperſum eſt, minime lædens ſubjectam carnem. Et plerumque tale fit, et illud eſt exquiſitum eryſipelas*; "If a fluxion or congeſtion ariſes from a "mixture of blood and yellow bile hotter than uſual, "or even from hot blood alone much attenuated, the "diſorder is termed an eryſipelas; which has a much "greater heat than an inflammation, and a yellower "aſpect. If you touch or preſs it, the blood readily "diſappears, and again returns, appearing very thin "and florid. But yet an eryſipelas is not ſo painful "as an inflammation, nor is it like any kind of in-"flammation accompanied with a pulſation, reſiſt-"ance, or diſtention. Even ſometimes it appears "very moderate, and eſpecially when it is ſpread on-"ly about the ſkin, without at all injuring the ſub-"jacent fleſh; as it moſt generally does, and is then "a true eryſipelas." And a little after he adds, *Exquiſitum eryſipelas ſolius cutis affectus eſt*; "That a "true eryſipelas is a diſorder of the ſkin only." But as the part invaded with an eryſipelas appeared of a yellowiſh red colour; therefore the ancient phyſicians accuſed the bile as the principal cauſe; but we at preſent know that the ſerum of the blood is naturally yellow, ſo that if a little cruor ſtagnates with much ſerum in the pellucid veſſels, which are obſtructed

[c] Lib. II. Meth. Med. ad Glaucon. cap. 1. Charter. Tom. X. pag. 368, 369.

and

and inflamed, the affected part will then appear of a reddiſh yellow colour. Hence alſo appears the affinity which is betwixt an eryſipelas and a phlegmon, ſince they only differ in the magnitude of the obſtructing particles: for in a phlegmon the red part of the blood is accumulated in the obſtructed and diſtended veſſels, but in an eryſipelas, the ſerum of the blood mixed with a little cruor, becomes impervious in the ſame manner: alſo the ſeat of a plegmon is chiefly in the membrana adipoſa, whereas an eryſipelas invades either the external integuments of the body, or the internal membranous parts. And from hence alſo it appears, that an eryſipelas may degenerate into a phlegmon, from the dilating veſſels admitting a larger quantity of the red blood, and ſpreading the diſorder into the adipoſe membrane: alſo that ſometimes an inflammation may ariſe, as it were betwixt an eryſipelas and a phlegmon, in which caſe the ancient phyſicians termed the diſorder by a name compounded from both of thoſe affections. For ſoon after the paſſage, which we lately cited from Galen, he adds [b], *Quemadmodum id, quod ſubjectam carnem attingit, neque ex tenui omnino fluxione fit, non ſolum eryſipelas eſt, ſed mixtus affectus ex eryſipelate et phlegmone, in quo quandoque propria eryſipelatis ſymptomata prævalent, et à recentioribus medicis vocatur talis affectus eryſipelas phlegmonodes; quandoque autem phlegmones, et dicitur ideo phlegmone eryſipelatodes. Quod ſi neutrius (ſymptomata) evidenter prævalent, ſed æqualia videantur, phlgmonen et eryſipelas miſta eſſe dicuntur*; "That "an inflammation, which extends to the ſubjacent "fleſh, and does not ariſe entirely from the afflux of "a thin humour, is not a ſimple eryſipelas, but a "mixt affection from an eryſipelas and a phlegmon, "in which ſometimes the proper ſymptoms of an "eryſipelas prevail; and then this diſorder is by the "more modern phyſicians called a phlegmonode ery-

[b] Lib. II. Meth. Med. ad Glaucon. cap. 1. Charter. Tom. X. pag. 368, 369.

" ſipèlas; ſometimes alſo phlegmons prevail, and are " for this reaſon called eryſipelatode phlegmons. But " if the ſymptoms of neither of theſe appear to pre- " vail, but ſeem to be equal, the diſorder is ſaid to " be a phlegmon and eryſipelas mixed."

Œdema.] The word Οἴδημα ſimply ſignified a tumour, as was ſaid in the commentary on § 112. numb. 1. but in proceſs of time this name was underſtood generally to mean a ſoft tumour without pain, and eaſily yielding to the touch without an alteration in the colour of the ſkin, which tumour generally ariſes from watery humours diſtending the cellular membrane. But the œdema of which we here ſpeak is of a very different nature, being generally denominated *œdema callidum* to diſtinguiſh it from the former. It was demonſtrated in the commentary on § 379. that a true inflammation might ariſe in the arterial veſſels, which, by their minuteneſs, exclude the red and ſerous parts of the blood. A tumour therefore, which is painful, hot, and not red, but yellowiſh, or ſometimes even white, is to be called an œdema callidum; which only differs from an eryſipelas, in that the ſeat of the diſorder is placed in much ſmaller veſſels. It is ſometimes alſo called an eryſipelatous œdema, inaſmuch as it often nearly approaches an eryſipelas. It is frequently obſerved in the head and face, and is commonly termed the *gutta roſacea*. Some ſigns of this œdema are to be met with in Galen [c]; for though he aſſerts that any kind of tumour may be called by this name, or rather that it might be more particularly applied to cold tumours properly ſo called, yet in treating on the cure of an eryſipelas, whether ſimple or compounded with other diſorders, he ſays, *Quemadmodum autem ſæpe phlegmonæ admiſcetur Eryſipelas, ita etiam aliquando œdemati: ac vocetur, quod ex ambobus tum eſt conflatum, Eryſipelas œdematoſum*; " But in the ſame manner as a phlegmon is of- " ten compounded with an eryſipelas, ſo an eryſipelas

[c] Meth. Med. Lib. XIV. cap. 3, 4. Charter. Tom. X. pag. 321.

" may

" may be ſometimes mixed with an œdema, and may " be denominated, as being compounded of both, " an eryſipelas œdematoſa." But that he did not underſtand the caſe, in which the ſkin of the parts diſtended by a cold tumour became eryſipelatous, is ſufficiently evident from what he ſubjoins in the following chapter, where he ſays, *Quemadmodum autem ex bilioſa fluxione eryſipelas, ita ex phlegmate fit œdema, rarus quidam ac indolens tumor. Equidem ſcio aliter quoque œdemata provenire circa pedes in hydropicis affectionibus, phthiſibus, aliiſque pravis, qui vehementes ſunt, habitibus. Atque in illis quidem œdema plenitudinis hominem prementis eſt ſymptoma, nullum ſeorſum propriam curationem requirens, &c.* " But in the ſame " manner as an eryſipelas ariſes from a bilious afflux, " ſo an œdema may ariſe from phlegm, which is " then a ſoft and indolent tumour. I am indeed not " ignorant, that an œdema may alſo ariſe in another " manner about the feet in dropſical diſorders, in " conſumptions, and in other violent depravations " of the habit; and in theſe indeed the œdema is a " ſymptom of the plenitude which oppreſſes the pa- " tient, requiring no particular or diſtinct treatment," *&c.* But although he calls it an indolent tumour from his preconceived opinion, that it aroſe from pituita, yet it is very evident from the remedies which he recommends for the cure of this œdema, that it was rather of a hot than of a cold diſpoſition; for a little afterwards he adds, *At ſi ex pituitoſo humore in partem influente œdema conſtitit, abunde aliquando ſatisfacit ſpongia ſola, quæ ex aqua, in qua ſit aceti aliquid, maduerit, &c.* " But if the œdema proceeds from the " afflux of a phlegmatic humour into the part, the " cure will be ſometimes fully accompliſhed only by " a ſpunge, which has been moiſtened with vinegar " and water," *&c.*

Since therefore this œdema callidum has a true inflammation ſeated in the ſmalleſt lymphatic arteries, there will be always danger in this caſe, that the thin

lymph of the blood may acquire ſuch a coheſive diſpoſition, as may render it impervious and apt to obſtruct its ſmall veſſels; from whence the functions of the brain eſpecially may be diſturbed, as they depend on a free circulation of the finer humours through the ſmalleſt arteries, whether this diſorder be originally formed either in the encephalon, or by a tranſlation from ſome external part inwards. Add to this, that if the diſorder is violent, the ſmalleſt veſſels being deſtroyed may incline the parts to a ſudden gangrene.

Scirrhus with inflammation.] A ſcirrhus is a hard and unequal tumour, with little or no pain, ſeated chiefly in ſome glandular part. If it be confirmed or inveterate, it conſiſts of ſuch a matter as appears incapable of being diſſolved by any artifice, with which we are as yet acquainted, nor can it ever be ſeparated from the ſound parts by a mild ſuppuration. From whence it is evident how dangerous an inflammation is, when ſeated near a ſcirrhus, or when fixed in the integuments which inveſt a ſcirrhus, as it may then ſoon degenerate into a cancer, as we ſhall explain more at large hereafter, when we come to treat profeſſedly on a ſcirrhus. Galen[a] has very well diſtinguiſhed the hardneſs of a ſcirrhus from the reſiſtance of a phlegmon, when he ſays, *Phlegmone namque non durum* (σκληρὸν) *ſed reſiſtentem tumorem efficit* (ἀντίτυπον) *perinde atque utres ſunt liquida materia aut aere pleni*; "For a phlegmon is not hard, but occaſions a reſiſt-"ing tumour only in the ſame manner as when blad-"ders are filled with any liquor or with air."

[a] Comment. in Textum XXX. Epidem. Hippoc. Lib. VI. Charter. Tom. IX. pag. 389.

SECT.

SECT. CCCLXXXI.

BUT ſo often as theſe cauſes (375, 376, 377, 378, 379,) have produced this ſtagnation (371, 372, 379,) in the ſmall veſſels (372, 373, 374, 378, 379), then the blood, moved by the remaining vis vitæ, produces certain effects or ſymptoms, which are at the ſame time the proper ſigns of an inflammation.

Two cauſes are obſerved to occur in every inflammation ſeated in any ſeries of the arteries; namely, either an imperviouſneſs of the fluids occaſioned by a narrowneſs of the veſſel, or a concretion of the particles, or elſe laſtly, from their miſtaking their courſe (*errore loci*;) and the propelled humours being at the ſame time urged forwards with an increaſed velocity into the impervious veſſels by the vis vitæ acting behind them. If theſe concur, an inflammation is preſent; but if there is only an imperviouſneſs of the fluid, it affords the idea of obſtruction: which laſt is therefore the prediſpoſing or proegumenal cauſe of inflammation, while the procatarctic or acceſſory cauſe is the increaſed motion urging on the back of the obſtruction. But while theſe cauſes act, certain changes are produced in the inflamed part, which, being obſerved, afford the true diagnoſis of a preſent inflammation; but of theſe we are to treat in the following aphoriſm, in which they are enumerated in their proper order.

SECT. CCCLXXXII.

1. THE minute and ſcarce viſible obſtructed arteries are now enlarged by the diſtending blood, and from hence a red tumour. 2. The arterial lymphatic veſſels, which were be-

fore pellucid and invincible, do alſo ſuffer the ſame diſtention and alteration in colour; and from hence an increaſe of the redneſs; and eſpecially this, when the very ſmall veſſels and veſicles in the panniculus adipoſus are ſtuffed full of thick blood, deprived of its more fluid parts. 3. The ſmall veſſels being ſo far diſtended as to be near upon breaking their ſmalleſt fibres; from hence follows a pricking pain. 4. The ſolids and fluids are both violently compreſſed or compacted together, and from hence a hardneſs and reſiſtance in the part. 5. From an accumulation of the red blood which is violently impelled into the veſſels, ariſes a ſhining redneſs. 6. From the reſiſtance, pulſation, compreſſion of the veſſels as yet pervious, but made narrower by the enlargement or dilatation of thoſe which are obſtructed; thence ariſes a violent attrition of the parts of the juices againſt each other, and againſt the ſolids, as alſo of the ſolids againſt them; and from hence follows the heat or burning of the part. 7. Becauſe the blood impelled from the heart does by the force, which it acquires from that muſcle, dilate the ſides and extremities of the obſtructed veſſels; from hence follows a pulſation. 8. From an irritation of the fibres, and a ſwifter courſe of the blood through thoſe veſſels which are open, (ſince it is returned by the veins, but obſtructed in many of the arteries;) from thence ariſe a quick pulſe, fever, thirſt, heat, watchings, weakneſs, and uneaſineſs.

1. It was demonſtrated in the commentaries on § 120. where we treated of thoſe effects which followed

lowed from obſtruction as the cauſe, that the obſtructed veſſels were of neceſſity extended or dilated. For that force, with which the heart propels the blood into the arteries, cauſes their ſides to recede from the axis of the veſſel, ſince they are full, and gradually converge, or become narrower. The reſiſtance therefore at the extremities of the arteries, and their fulneſs, are the principal cauſes why they are dilated by the impulſe of the blood: but in obſtructed veſſels there is the greateſt reſiſtance and at the ſame time the greateſt fulneſs, ſince nothing can be tranſmitted through their extremities; a great dilatation of them muſt therefore of neceſſity follow. If now we alſo conſider, that an inflammation is accompanied with an increaſed motion of the blood, it will evidently appear, that the veſſels muſt be more largely extended when there is an inflammation, than when they are barely obſtructed. But when this dilatation is made in thoſe arteries which naturally convey the red blood, or which admit the blood when they are dilated by diſeaſe, it is evident, that the tumour formed by that diſtention muſt appear red: for if an obſtruction or inflammation is ſeated in the ſmalleſt veſſels, they may be in the utmoſt diſtention which they are capable of bearing without a rupture, and yet may they exclude the red part of the blood, as we ſaid at § 379, and 380. Even this diſorder may be conceived to reſide in veſſels ſo extremely minute, that even the tumour reſulting from their dilatation may be too ſmall to come under the obſervation of our ſenſes. But concerning this ſee more in the commentary on § 122. But a true inflammation, properly ſo called, is always ſeated in thoſe veſſels, which either naturally contain the red blood, or which are capable of receiving it when dilated, as is evident from the definition given of it at § 371.

Beſides this the increaſed heat, which accompanies every inflammation, makes another addition to the bulk of the tumour, as will be preſently demonſtra-

ted at numb. 6. for it appears from certain experiments, that all bodies expand throughout all their dimenſions by an increaſe of heat.

2. A ſerous artery is derived from the leaſt ſanguiferous artery, in the ſame manner as a branch is derived from its trunk; but the ſides of the ſanguiferous arteries cannot be diſtended without diſtracting and enlarging the orifices of the ſerous arteries which ariſe from them; from whence the red part of the blood may enter through their dilated orifices. The ſame is alſo true with reſpect to the lymphatic arteries, which are derived from the ſerous arteries: for that theſe may be ſo diſtended, as to be capable of receiving the red part of the blood, is apparent in opthalmias or inflammations in the eyes, as we ſaid a little before. From hence therefore will manifeſtly follow an increaſe of the redneſs of the tumour. But neither is all this ſeemingly ſufficient to produce ſuch enormous tumours as are frequently obſerved in violent inflammation. Now we demonſtrated in the commentary on § 374. that an inflammation fixes itſelf in no part more frequently and firmly than in the fat, when the ſmall veſſels of this membrane are ſtuffed up with impervious blood, and diſcharged through the orifices of the veſſels which open into the cells of the membrane; from whence this adipoſe membrane, which is ſo eaſily dilatable, is often diſtended in a ſurprizing manner. Galen[a] has very well obſerved this cauſe of the tumour in a phlegmon; for after having ſaid that no tumour can ariſe without the acceſſion of new matter to the ſwelled part, or without a diſſolution of the parts by the violent heat, ſo as to paſs into air, which might diſtend the part into a larger bulk; as for example in the ſame manner as water being rarefied by heat into vapours, occupies an immenſe ſpace: but he proves that the tumour in a phlegmon does not ariſe from this rarefaction of the

[a] De Tumoribus præter naturam, cap. 2. Charter. Tom. VII. pag. 313.

juices

juices, ſo as to diſſolve them into vapours of air; for ſays he, *Apparet enim, ſi ſecta fuerit pars phlegmone laborans, ſanguis effluens plurimus, et locus univerſus ſanguine pleniſſimus, quemadmodum ſpongiæ madentes; ſpiritus autem neque ſtatim excidit, neque poſtea*; "For it appears, that if the part afflicted with a "phlegmon be laid open by inciſion, much blood "flows from it, and the whole part ſeems extremely "full of blood, in the ſame manner as ſpunges full "of water, but no air or ſpirit is diſcharged either "immediately or any time after." And in the end of the ſame chapter he adds [b], *In inflammationibus autem omnia ſanguine replentur, ex vaſis per eorum tunicas reſudante, in omni vero carnis parte roris inſtar permixto*; "But in inflammations all the parts are filled "with blood, tranſuding through the coats of their "veſſels, ſo as to mix like dew with every part of "the fleſh." But by fleſh Galen underſtands the tunica adipoſa, as is evident from what was ſaid in the commentary on § 374. as alſo from many other paſſages in his writings. For in the chapter lately mentioned he carefully obſerves, that a tumour, which accompanies an inflammation, is very different from that which ariſes from an increaſe of the habit of body; making uſe of the word πογυσαρκίας, to denote a greater obeſity.

But when the red part of the blood enters the ſmaller dilated veſſels, it there mixes both with the ſerum and thinner lymph contained in thoſe veſſels; but here the red part only of the blood remains impervious, being wedged into the narroweſt parts of the converging veſſels, while the more fluid parts will be carried off by the lateral veſſels, which open betwixt the obſtruction and the preſſure which urges behind; and from hence the red part only will be more and more accumulated in the obſtructing veſſel, which

[b] De Tumoribus præter naturam, cap. 2, Charter. Tom. VII. pag. 315.

will

will again prove another cauſe increaſing the redneſs in the inflamed part.

3. Since therefore the veſſels are diſtended by the impulſe of the humours urged on behind the obſtructing matter, from hence their coats, and conſequently the nervous fibres diſperſed through them, will be diſtracted; which will excite pain, as is evident from what has been ſaid in the commentaries on § 220, and 224. numb. 2. But ſince the largeſt veſſels which are interpoſed betwixt the ſanguiferous and the ſmalleſt arteries, (namely, the ſmalleſt extremities of the arteries which convey the red blood) does not equal in thickneſs the tenth part of a hair of the head, it is evident, that the diſtraction of the nervous fibrillæ diſperſed through the coats of ſuch a ſmall veſſel, muſt excite a pain, as if in a ſingle point of the body only; and from hence the pain is ſaid to be pricking. But one of theſe ſmalleſt ſanguiferous arteries is yet much larger than either the ſerus or lymphatic; though even in theſe, there is a like diſtraction and pain produced in a point ſtill leſs. So that a hundred of theſe ſmall veſſels being inflamed, will cauſe a pain as if it was fixed in a ſingle point; only becauſe the impulſe of the humours behind the obſtruction ſo diſtends the vaſcules, that the nervous fibres conſtituting their ſides, are in danger of breaking. And from hence it is that when ſo much blood is drawn from a vein in a violent pleuriſy, that the patient faints away, the pain either intirely vaniſhes, or at leaſt is much diminiſhed.

4. Our blood when at reſt ſeparates into two parts, the one a red concrete, and the other a watery ſerum, in which the red part ſwims. But there are two principal cauſes in the body which prevent this concretion; namely, a continual motion, and the interpoſition of a thinner fluid betwixt the red globules, by which they are removed from their mutual contacts. But when this red part of the blood ſtagnates in any of the ſanguiferous veſſels, or becomes impervious in any

of

of the ſmaller dilated veſſels, its more fluid parts are expreſſed, as we ſaid before at numb. 2. under the preſent aphoriſm, from whence follows a compreſſure, and a combination of the red globules with each other, and as they are flexible, their ſpherical figure will be flattened, and they will touch one another in more points, and by that means begin to cohere more ſtrongly. Theſe cauſes therefore continuing, the red globules will be accumulated in the much diſtended veſſels, as alſo in the cells of the tunica adipoſa; and from hence a greater hardneſs and reſiſtance of the inflamed parts will neceſſarily follow. But as veſſels thus diſtended compreſs thoſe which lie next to them, the capacities of theſe laſt being thus diminiſhed, will propagate the diſorder through the whole inflamed part. For this reaſon Hippocrates often places hardneſs and pain for an inflammation. Thus in his prognoſtics[c], in treating on an inflammation of the bladder, and the conſequences which thence follow, he ſays, *at veſicæ duræ et dolentes, &c.* And in other places, as Hollerius[d] remarks, he diſtinguiſhes a phlegmon from other tumours by the hardneſs and pain.

5. The thinner parts of the juices being expreſſed, leave only the red parts of the blood accumulated in the diſtended veſſels; whence *(cæteris paribus)* the redneſs is alſo much the greater, in proportion as the inflammation is more violent. But the ſkin being in moſt parts of the body looſe and moveable, is very much diſtended by the impervious blood ſtagnating in the adipoſe membrane, inſomuch that it ſhines with a ſmooth ſurface; for the tenſe ſkin always ſhines, as it is ſaid to do in fat people, being diſtended by the accumulated fat. Thus the well fed dog was aſked by the lean wolf from whence he ſhined with that fatneſs[e]. And we daily obſerve, that the tenſe ſkin

[c] Sentent. 71. Charter. Tom. VIII. pag. 659.
[d] Comment. in Coac. Prænot. Hippoc. pag. 552.
[e] Phædr. iii. 7.

looks

looks beautifully ſmooth and ſhining in young people, whereas in old age it is beſet with ugly wrinkles.

6. We are aſſured from certain experiments, that the moſt intenſe heat may ariſe barely from the attrition of bodies againſt each other, and even that actual fire may be by this way produced. (See our chemiſtry, vol. i. pag. 176.) It has been alſo proved that the heat ariſing from this attrition is ſo much the greater in proportion as the bodies are more rigid and elaſtic; and alſo that it increaſes in proportion as the bodies are more forcibly preſſed againſt each other, and as they are more ſwiftly agitated[r]. But it is certain that water or any other liquor being interpoſed between the bodies while they are rubbed againſt each other, prevents the heat from becoming ſo intenſe, as it will when there is no ſuch liquor interpoſed; from whence it would ſeem, that heat cannot eaſily ariſe from the attrition of our fluids againſt the ſides of their containing veſſels. But if we conſider that the globules of the blood are elaſtic, and alſo moved very ſwiftly through elaſtic veſſels, which converge in ſuch a manner, that in the ultimate extremities of the ſanguiferous arteries, hardly more than a ſingle globule can paſs through at a time; and that therefore the more thin parts of the juices being carried off by the lateral branches, the largeſt globules will be ſtrongly preſſed and rubbed againſt the ſides of the veſſels; from hence it is ſufficiently evident that heat muſt ariſe from this attrition; ſo that in ſtrong people who have a thick blood, a greater heat is uſually obſerved. But when the blood, being diſſolved, inclines more to the nature of inelaſtic water, the heat is always obſerved leſs, and for the ſame reaſon a greater heat always accompanies a ſwifter motion of the blood through its veſſels. Nor is it any objection to this, that the impervious blood

[r] Videatur de his omnibus Boerhaavii Them. Tom. I. pag. 176, &c.

ſtagnates

ſtagnates in the obſtructed veſſels of the inflamed part; ſince it appears from the experiment of Lewenhoeck, alledged in the commentary on § 132. that ſuch impervious particles of the blood are repelled back by the contraction of the artery, at the inſtant when the heart does not act, and that ſoon after they are again propelled to the obſtructed part of the artery, while the blood is ſent forward by the ſyſtole of the heart; whence it is evident that thus the obſtructing particles may run forwards and backwards in the ſame veſſel. But ſince it appears from what has been ſaid before, that the thinner juices are continually expreſſed, while the groſs and impervious particles of the blood are accumulated and condenſed, while the velocity of the blood's motion is alſo augmented through the inflamed part, the reaſon will be evident, why ſuch a conſiderable increaſe of heat muſt neceſſarily follow. But the adjacent veſſels which are not yet obſtructed, will be compreſſed and made narrower by the diſtention of the inflamed veſſels; whence will follow a greater attrition of the compreſſed veſſels, partly from a diminution of their capacity, and partly from the increaſed velocity of the fluids to be tranſmitted. For if out of an hundred veſſels, fifty of them are obſtructed, the blood muſt then paſs as ſwift again through the fifty which remain pervious. Every circumſtance therefore concurs in an inflammation, from which we are aſſured by experiment a greater heat may ariſe. For the blood being deprived of its more fluid parts, concretes almoſt into a ſolid maſs, which is every moment condenſed more and more by the violent action of the veſſels, and the impulſe of the humours acting behind: the veſſels compreſſed by thoſe which are diſtended, will be applied more ſtrongly to their contained humours, and the motion of the fluids through the veſſels will be in general accelerated. From hence the reaſon appears why an inflammation does by the ſimilitude of its cauſes and effects derive its name from fire, as was ſaid before at § 370.

7. Since

7. Since the whole body is found, by the modern anatomy, to contain arteries diſperſed throughout almoſt every point of it; and that all theſe arteries are dilated at one inſtant of time, while the heart is in its contraction, and that they are again contracted the moment following, while the heart is in its dilatation; it will be evident, that almoſt every point of the body receives a motion of pulſation every moment of life. But we do not naturally take any notice of this motion; even though it is very ſtrong, and always performed in our bodies by the ſame laws; but ſo ſoon as this motion exceeds its uſual bounds, we preſently perceive it. Thus the ſtrong pulſation of the heart, which may be ſo eaſily perceived by applying the hand to the breaſt, is not at all felt by a perſon in health, but ſo ſoon as it exceeds its due motion by paſſions of the mind, a violent motion of the body, *&c.* then the heart is perceived immediately to palpitate. It is no wonder, therefore, that a pulſation ſhould be perceived in the inflamed part, which was not obſerved in it before; for the blood thrown into the obſtructed arteries by the force of the heart, will ſpend all its force in removing the ſides and extremities of thoſe arteries; and from thence the ſides of the arteries will recede farther from their axis, and when the force of the heart ceaſes, they will return or contract again with ſo much a greater force, in proportion as they were more diſtended. The pulſe will be therefore thus increaſed in the inflamed part, and being raiſed in ſtrength and velocity beyond its natural action, it will be very diſtinctly perceived.

8. When the ends of the arteries are obſtructed, the humours contained in the veins, correſponding to thoſe arteries, do nevertheleſs return to the heart; but being afterwards propelled by the heart, they cannot paſs through the obſtructed arteries, but muſt run with ſo much a greater velocity through thoſe arteries which remain pervious. For, in this caſe, the quan-

quantity of humours to be tranſmitted through the veſſels, is not diminiſhed, though there is a leſs number of the pervious or tranſmitting veſſels; from whence it is ſufficiently evident, that the blood muſt paſs with an increaſed velocity through the other veſſels which remain pervious. But, at the ſame time, it is alſo from hence apparent, that this cauſe will not be ſufficient to increaſe the velocity of the humours, ſo as to render it ſenſible to the phyſician, unleſs the affected part is ſo large, that the number of its impervious veſſels will make a conſiderable difference, when compared with thoſe that remain open: for if a thouſandth part of the arteries are thus obſtructed by an inflammation, the increaſed velocity required to move the blood through the reſt of the open veſſels, ſeems to be ſcarce within the reach of obſervation. Another cauſe is therefore neceſſary to account for the frequent attendance or following of a fever after an inflammation; which fever we frequently obſerve, even when the inflammation is ſeated in but a very ſmall part of the body: for thus a very violent fever often attends, when an inflammation is ſeated in but a very ſmall membrane; as, for inſtance, in the paronychia or witloe. Therefore it is added in the text, from an irritation of the fibres. When we treated of the effects of pain, in the commentary on § 226. it was demonſtrated, that a fever might ariſe from pain only; and for the ſame reaſon a violent fever ſo frequently accompanies the moſt painful inflammations: whereas an inflammation is not often attended with a fever, when there is little or no pain; whence it follows, that the fever ſeems to ariſe chiefly from the irritation of the nervous fibres diſperſed through the inflamed veſſels and membranes, which are too violently ſtretched or preſſed. That there is in reality ſuch a power or diſpoſition in our veſſels, as renders them liable to irritation, whereby the circulation of their humours is accelerated, we are taught by many obſervations.

When

When the offending matter is diſſolved in acute diſeaſes, it flows through the veſſels, and is often tranſlated or ſettled upon ſome other part, or elſe it is diſcharged from the body by critical evacuations; and in theſe changes, what wonderful diſturbances frequently ariſe in the body? and in what a ſurprizing manner is the pulſe often accelerated and diſcompoſed? When the chyle, which is made from too large a quantity of aliments, or from ſuch as are more compact or acrimonious than uſual, comes to circulate with the blood through the veſſels, it produces a fever; but of this we ſhall treat hereafter, in the hiſtory of fevers; and it may be at preſent ſufficient for us, only to obſerve this in general, in order to ſhew, that an irritation of the fibres may produce a fever.

But the ſigns of a fever attending, are the appearance of its chief ſymptoms, thirſt, heat, watchings, *&c.* of which we ſhall treat particularly in their proper places. But it is to be obſerved, that theſe ſymptoms do not attend every inflammation, but only when the whoſe maſs of blood has acquired ſuch an inflammatory ſpiſſitude, that it cannot eaſily paſs through the ſmalleſt veſſels. For it appeared before, that in healthy blood there is naturally an inclination to concretion, and the more, as the patient was of a ſtronger habit: but ſo long as this tendency to concretion can be overcome by the action of the veſſels in the viſcera, ſo long will the patient ſurvive. But we ſee daily in acute diſeaſes, that the blood is ſo much altered that at length it ſcarce retains its fluidity; it immediately congealing if not prevented by the frequent action or attrition of the veſſels. Thus the blood which drops from the noſe in ardent fevers immediately congeals into a ſolid maſs; inſomuch that often this thick blood ſtops up the ſmall arteries which were opened by nature to make a ſalutary diſcharge, in order to terminate the diſeaſe. Hence Hippocrates[s] juſtly condemns theſe ſmall diſcharges of

[s] N° 59.

blood

blood, in his Prænotiones Coacæ; and in another place [h], he gives inſtances of three patients, proving the fatal event, when this diſcharge of blood from the noſe was very ſmall on the fourth and fifth day. When therefore this inclination of the blood to concretion is augmented, it is ſufficiently apparent, that it will meet with more difficulty in paſſing through the ſmalleſt arteries; from whence will ariſe a greater reſiſtance to the heart: and ſince the lungs ought to receive and tranſmit the blood, which it immediately receives from the right ventricle of the heart, through the ſmalleſt extremities of its pulmonary artery; therefore the leaſt inclination of the blood to run into coheſions will be perceived in the lungs, whence again the reſpiration will be increaſed, in order to protrude the blood more forcibly through the lungs. Thus ariſes that uneaſineſs or anxiety, which is a bad ſign in all acute diſeaſes, and eſpecially in the inflammatory; that is, the reſpiration becomes laborious and difficult, and the patient declares his anxiety and uneaſineſs by continually changing the poſture of his body. This is the συσφορία, or heſitation of the blood, as it is called by Hippocrates, which though it may be the conſequence of other cauſes (as will be hereafter declared in § 631, et ſeq.) does yet more frequently proceed from an impervioufneſs of the blood.

It is therefore evident, from all that has been ſaid under this aphoriſm, that a phlegmon is known by theſe ſigns, to be a red tumour, tenſe and ſhining, with a pricking pain, heat, and pulſation, accompanied with a fever, either in the whole, or at leaſt in that particular part of the body.

[h] Epidem. I. Textu 63. Charter. Tom. IX. pag. 65.

SECT. CCCLXXXIII.

AND this is the ſtate (382) of a phlegmon before the diſorder has arrived to its full height.

All the ſigns enumerated under the preceding aphoriſm are obſerved in a phlegmon, which is increaſing, but has not yet arrived to its full height: for there are three ſtages obſerved by phyſicians in all diſeaſes; namely, their increaſe, height or ſtate, and their declenſion. Their increaſe is ſaid to be as long as all their ſymptoms grow worſe; and the ſtate or height of the diſorder, is, when the ſymptoms are arrived to their greateſt degree of malignity, and do not afford any ſenſible ſigns of their augmenting or diminiſhing; but the declenſion of the diſorder is when the violence and number of the ſymptoms gradually diminiſh. Thus when a phlegmon has arrived to its full height, it then begins to be diſpoſed to terminate either by reſolution, which we call health, or into ſome other diſeaſe, as an abſceſs by ſuppuration, a gangrene, a ſphacelus, a ſcirrhus, *etc.* as we ſhall preſently declare more at large. But at the time of change, many of the ſigns or appearances which accompanied the phlegmon as not yet adult, are conſiderably altered, or elſe removed, and other new ſigns appear, which were not to be obſerved before: Thus, for inſtance, the redneſs, tenſion, pain, and hardneſs, which are obſerved in a phlegmon, begin to diminiſh when it tends to a gangrene, and at length they even quite vaniſh, and are, on the contrary, ſucceeded by an inſenſibility of pain, a pale aſh or brown colour, flaccidity, puſtules full of ichor, *etc.* Theſe ſtages are therefore to be carefully diſtinguiſhd, as well in a phlegmon, as in other diſeaſes, in order to determine

determine any thing with certainty in relation to the diagnoſis, prognoſis, and curative indications.

SECT. CCCLXXXIV.

If now blood be drawn, in a full ſtream from a larger orifice in a vein, into a baſon; as it grows cold, it forms a white, hard, thick and tough ſkin, almoſt like the ſkin of pork.

When blood is drawn from a perſon who has a violent inflammation, it affords an appearance ſurpriſing enough. It is well known, that the blood congeals ſometime after it has been received from the vein, and ſtood ſtill in a baſon; and that it then ſeparates into two parts; the one a thin yellow coloured liquor, and the other a red concrete, uſually ſwimming in the former; which laſt is uſually termed the craſſamentum. But in acute, and moſt of the inflammatory diſeaſes, the upper ſurface of the craſſamentum appears covered with a white or light bluiſh coloured ſkin, which is frequently ſeveral lines thick; and is ſometimes ſo tough, and firmly adhering to the craſſamentum, that it with difficulty admits of being divided, even by a razor. As this tough ſkin is almoſt conſtantly obſerved in the blood of thoſe who are afflicted with a pleuriſy, therefore when phyſicians ſee the ſame appearance in the blood extracted in other diſeaſes, they term it pleuretic blood, though it is not reſtrained to a pleuriſy only. There are ſeveral obſervations more than a little ſurpriſing, to be met with in authors concerning this appearance; thus Sydenham [a] has remarked, that if the blood does not flow in a direct or horizontal ſtream, but runs trickling down over the ſkin, that then this tough cruſt will not appear on the ſurface of the blood, even though it flowed faſt enough from the orifice; and

[a] De Pleuritide, pag. 333, 334.

he ingenuouſly confeſſes himſelf ignorant of the cauſe of this difference. He has alſo obſerved, that the patient is not relieved by that manner of bleeding as he is when the blood runs in a full ſtream, and appears covered with this cruſt; and he takes notice, that any other obſtacle which impedes the free exit of the blood from the orifice of the vein, will alſo hinder the generation of this cruſt or ſkin, and occaſion the patient to be leſs relieved by it. But what is ſtill more wonderful, it has been obſerved that this ſkin will not be formed, even though the blood has been drawn in a full ſtream from the vein, provided it is but ſtirred round with the finger: Therefore the origin of this cruſt appearing on the ſurface of the venal blood, ſeems to be very obſcure. But whether or no it is produced from the ſerum of the blood, inclined by diſeaſe to a greater degree of coheſion, is what may be queſtioned; though it is certain that it always occupies the ſurface or upper part of the craſſamentum, which ſwims in the ſerum. Whether or no is it formed of the crude chyle, not yet converted into the blood? This is the opinion of the acute Simſon [b], but it ſeems to be an objection to this, that the chyle mixed with, and not yet converted into the blood, muſt ſwim in the ſerum, and not cohere to the craſſamentum. The ſame author obſerves, that if a ſtrict ligature be made about the arm or thigh, and a vein being opened three or four hours afterwards, ſo as to let the blood flow out in a full ſtream, that then this ſkin will always appear; as it is alſo conſtantly found in the blood of women with child. Whence he places the cauſe of it in the remora or ſtagnation which the blood ſuffers in the veſſels, obſtructed ſometimes by ligatures, or by the preſſure of the uterus in gravid women; or at leaſt becauſe it is moved more ſlowly. To ſpeak the truth, I muſt confeſs myſelf in a doubt what to think concerning this tough ſkin, which always moſt firmly

[b] De Re Medica Diſſert. quatuor, pag. 112.

adheres

adheres to the ſurface of the craſſamentum. It is the opinion of many learned and eminent phyſicians, that this cruſt is formed while the blood is more inſpiſſated and inclined to concretion by an increaſed velocity of its motion; and therefore they judge it to be rather an effect of conſequence than a prediſpoſing cauſe of the diſeaſe. But I have frequently obſerved, that ſuch a cruſt has appeared in the blood of the moſt healthy people, who open a vein every year in the ſpring; and even in a weak man, who bled every three months to prevent an hæmopthoe: in which caſe there was therefore ſuch a diſpoſition of the blood, even though there was no inflammation; and on the contrary, no ſuch cruſt has been obſerved in ſome of the moſt violent inflammatory diſeaſes, which has then been always received as a very bad ſign.

SECT. CCCLXXV.

THE diſorder increaſing, all theſe ſymptoms (382, 383, 384,) continue, but in a greater degree; and in the mean time the expreſſed lymph is carried off, and the red blood more inſpiſſated.

All the ſymptoms which have been hitherto conſidered, aroſe from the heſitation of the impervious blood in the ſmalleſt extremities of the converging arteries, and from the impetus of the blood more forcibly impelled behind, and urging on the back of theſe obſtructions: if therefore the tenacity of the obſtructing matter is increaſed, or takes place in more of the ſmall veſſels, while the impulſe of the blood urging behind is alſo augmented; it is very evident, that then all the ſymptoms muſt be increaſed. From hence a greater tumour of the inflamed parts, with a colour inclining towards purple, by reaſon of the extreme redneſs, a burning heat, intenſe pain from the diſtracted fibres being almoſt upon the point of break-

ing, with an extreme tenſity or ſhining of the part, &c. And ſince the blood cannot paſs through the obſtructed veſſels, into which it is propelled, the thinner parts will go off by the lateral veſſels, the red part will remain alone impervious, and will be applied and compacted againſt the obſtructing matter by the force of the blood urging behind; from whence the quantity of obſtructing matter will be continually increaſing, and therefore its removal will become the more difficult.

SECT. CCCLXXXVI.

If the circulating humours are mild or not acrid, their motion ſedate or not exceſſive, and the obſtructing cauſe not too violent, the obſtruction itſelf alſo but ſmall, and ſeated either in the ſanguiferous or in the beginning of the lymphatic arteries, then the obſtructing matter concreted by ſtagnation, being reduced to a ſtate of fluidity by the motion of the veſſels or diluting juices, the inflammation then terminates by a reſolution or diſperſion.

Every diſeaſe terminates either in health, another diſorder, or in death; which is a general rule that takes place likewiſe in inflammations: and therefore we are next to conſider the various ways in which they terminate. When the inflammation is ſo diſperſed, that nothing of the diſorder remains, and all the parts are reſtored to their functions which they formerly performed in health, without any other diſorder following, it is then ſaid to be cured. But if the inflammation turns to a ſuppuration, the firſt diſorder is indeed removed, but then another comes in its place; namely, an abſceſs follows. The ſame is alſo true if the inflammation turns to a ſcirrhus. But when a moſt violent inflammation totally intercepts the

the vital influx and efflux of the humours to and from the affected parts; in that caſe the inflammation indeed ceaſes, but is followed with a gangrene firſt, and then with a ſphacelus, which laſt is a true mortification or death of the part.

Of all the ways therefore of terminating an inflammation, the moſt deſirable is that which phyſicians call a reſolution or diſperſion. That is, when the impervious matter, heſitating in the obſtructed veſſels, is by the remaining vis vitæ and the uſe of proper remedies ſo diſſolved, or the veſſels in which it is ſeated ſo diſpoſed as to let that impervious matter paſs into the veins, or elſe be repelled back into the larger veſſels: ſo that thus a free circulation of the humours is reſtored through the veſſels, before impervious, without injuring their continuity; and the concreted fluid being now diſſolved, and mixed with the circulating humours, may paſs freely through thoſe narrow extremities of the veſſels, which it ought to pervade agreeable to the laws of health. And when this takes place, the inflammation is ſaid to be cured by a reſolution.

It therefore remains for us to enquire into thoſe ſigns which denote that this reſolution is practicable; and all theſe we find enumerated in this aphoriſm. For the treatment is required to be very different, when it ſhall appear, that the inflammation will terminate in a different manner from that above mentioned, as will appear evidently from what follows.

If the circulating humours are mild.] All our healthy juices (except perhaps the bile, and thoſe which are excrementitious) are ſo mild and inoffenſive that they do not excite pain, even though they touch the eye or a naked nerve in a recent wound: and this was neceſſary, that they might paſs with a pretty ſtrong impulſe in a healthy ſtate through their very tender veſſels, and yet not injure them. Since therefore the reſolution of an inflammation ſuppoſes a motion of the ſtagnating humour, and a reſtitution

of its concreted parts to their former fluidity, without any deſtruction of the veſſels; it is very evident that in this caſe they can have no conſiderable acrimony, for when the blood is forcibly impelled by the heart into the obſtructed veſſels, it is then preſſed back again by the contraction of thoſe veſſels, while the heart is in its diaſtole; by which means the ſides of the veſſels will ſuffer a conſiderable attrition from the humours, ſo that if they contained acrimonious particles, it is evident that theſe tender ſmall veſſels would be diſſolved and deſtroyed. This is the reaſon why, in ſcorbutical patients, the ſlighteſt inflammation ariſing in the legs, even from external cauſes, can hardly ever be cured by a reſolution; but it almoſt conſtantly degenerates into an ulcer; and the ſame is alſo obſerved in all other ill habits of body, in which the juices are infected with an acrimony.

Their motion ſedate.] It was demonſtrated in the commentary on § 120, that when an obſtruction is formed, the obſtructed veſſel is diſtended, dilated, and rendered thinner by the impulſe of the fluids; ſo that it at length burſts aſunder. But in that caſe the humours had no greater velocity than is uſual in an healthy ſtate; and it is very evident, that if the impulſe of humours in the obſtructed veſſels is increaſed, the ſolution of their continuity will be more ſpeedily effected. But in order to diſperſe or reſolve an inflammation, it is required to preſerve the continuity of the veſſels; and therefore when an inflammation is accompanied with the moſt violent motion of the humours, there can be no hopes of a reſolution.

The obſtructing cauſe not too violent or confirmed.] An increaſed motion of the humours is not only prejudicial, inaſmuch as it may break the continuity of the obſtructed veſſels, but alſo inaſmuch as it compacts the obſtructed particles together with a greater force. But to diſperſe an inflammation, it is required to reſolve the obſtructing concrete into thoſe ſmall particles,

particles, by whoſe combination the obſtruction is formed: but the more the thinner humours are expreſſed, which prevent the mutual contacts of the groſſer particles; ſo much the more ſtrongly will theſe laſt be united and preſſed together, the more firmly will they cohere, and the more difficult will it be to diſſolve them again. But when the velocity of the circulation is increaſed, the thinner humours are diſſipated, and the groſſer compacted together, as we demonſtrated in the commentary on § 100, and at the ſame time the compacting cauſes, which drive the impervious particles cloſe to each other in the obſtructed veſſel, are oftener applied in a given time. Hence appears the reaſon why the moſt ſkilful phyſicians deſpair of a reſolution in a pleuriſy and ſuch like diſeaſes, in which a moſt violent fever has attended for above twelve hours time, and rather direct all their curative intentions to promote the concoction and excretion of the inflammatory matter.

The obſtruction ſmall, and ſeated either in the ſanguiferous or in the beginning of the lympatic arteries.] An obſtruction is ſaid to be ſmall, either with regard to the part of the veſſel which it occupies, or elſe becauſe it takes place in but a few veſſels of the part affected. Thus for example, if a red globule ſtagnates in the beginning of a dilated ſerous veſſel, that obſtruction may be more eaſily removed, than if the globule penetrated to the ſmalleſt extremity of the ſame ſerous artery. And alſo if the greater number of veſſels in any part of the body are obſtructed, each of theſe being dilated will compreſs and ſtraiten thoſe which are adjacent; whence the reſolution of ſuch an obſtruction will always become the more difficult. But an inflammation may be diſperſed moſt eaſily of all, when (*cæteris paribus*) the diſorder is ſeated only in the larger veſſels: for the efficacy of bleeding, and moſt of the other remedies for inflammations, is exerted chiefly in the larger veſſels. Thus for example, if the red part of the blood ſtagnates in

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the ſmalleſt extremities of a ſanguiferous artery, or has entered into the ſerous veſſels by error of place, or elſe into the lymphatics which are of the next magnitude to the ſerous veſſels, it is evident that the obſtructing matter ought to be ſo attenuated or diſſolved, or the obſtructed veſſels ſo relaxed as to afford a paſſage; or elſe, laſtly, the obſtructing matter muſt be repelled back from the ſmaller to the larger capacity of the veſſel. But a red globule readily diſſolves into the ſerous globules of which it is compoſed, according to the obſervations of Leeuwenhoek; and thus likewiſe may the ſerous globules diſſolve into the ſmaller lymphatic ones; therefore ſuch an obſtruction, ſeated in the ſanguiferous or in the beginning of the ſerous and lymphatic arteries, may be thus terminated or reſolved. But if a red globule ſhould have entered veſſels much ſmaller than theſe, it would not be capable of paſſing through its ſmaller extremities, even though it was to be reſolved into ſerous or lymphatic globules; from whence the difficulty of reſolving the inflammation in this caſe is ſufficiently evident. Another means of the greateſt efficacy in the reſolution of inflammations, is the diminution of the quantity and impulſe of the humours urging on the back of the obſtructions, made by a plentiful bleeding, that the obſtructing matter may be repelled by the natural contraction of the veſſels from their narrower to their larger capacities, (ſee § 141.) This repulſion depends upon the re-action of the veſſel, when the cauſe of its diſtention ceaſes, and therefore it will take place the moſt effectually in the largeſt veſſels, which have the ſtrongeſt and moſt elaſtic membranes or coats; whereas little good can be from hence expected, when the obſtruction is ſeated in the ſmalleſt and moſt tender vaſcules. From hence therefore the reaſon is evident, why it is neceſſary for the obſtructing matter not to be ſeated in the ſmalleſt veſſels, in order to cure the inflammation by a reſolution or diſperſion. This is confirmed by many

ny practical obſervations, and is moſt apparently demonſtrated in an ophthalmia, in which diſorder we may very plainly perceive the inflamed veſſels of the eyes. For as long as the veſſels of the tunica adnata only appear, and there is no apparent defect in the pellucid cornea, there are great hopes of obtaining a perfect reſolution without any defect remaining: but when the very minute and pellucid vaſcules of the cornea are dilated ſo as to admit the groſſer humours, the inflammation can never be ſo entirely diſperſed, but either a ſuppuration or opake ſpot will be left in the cornea, which will ſometimes disfigure the eye as long as the patient lives.

The veſſels moveable.] For the maintenance of health it is required that our veſſels yield to the impulſe of the fluids; and then again for them to return to their former diameter, when the diſtending cauſe ceaſes; and this is called the mobility of the veſſels. Now there are two different and even oppoſite cauſes, which diminiſh, and may even ſometimes totally deſtroy the due mobility of our veſſels; namely, when their ſides or coats are ſo much relaxed, that they very eaſily give way to the humours impelled by the heart, but have ſo ſmall a degree of ſtrength or elaſticity, that when the heart ceaſes to act, their force is not ſufficient to propel forwards their contained blood; and on the contrary, the ſides of the veſſels are ſometimes ſo rigid, as ſcarcely to ſuffer them to be dilated by the impulſe of the humours. The firſt of theſe defects is therefore a too great weakneſs, and the latter, a too great ſtrength of the veſſels. When the veſſels are too weak, they may be ſo dilated, even by a ſmall force, as to admit the groſſer parts of the blood to miſtake their courſe; but then, as they eaſily give way in this caſe, their ultimate extremities may be ſo dilated, as to readily tranſmit the groſſer obſtructing parts of the blood into the veins; whence it will be no great difficulty to remove the obſtruction. To which add, that in this caſe

caſe the motion of the humours is always languid, and the fluids are never denſe or compact for want of ſtrength in their veſſels; whence it readily appears, that inflammations ſeldom ariſe in ſuch habits, and that there is no great difficulty in curing them when they do ariſe. But when there is too great a ſtrength in the veſſels, the blood is always compact or denſe, and deprived of its more fluid parts, which will cauſe the more groſs parts to unite, and render the inflammation difficult to remove when it is once formed; and this partly from the thickneſs and impervioufneſs of the humours, and partly from the greater ſtrength or contractal power of the obſtructed veſſels, by which they reſiſt dilatation, and more ſtrongly confine the obſtructing particles. This is daily obſerved in practice, where acute or inflammatory diſeaſes in women or children are often eaſily cured by a mild reſolution; but very ſeldom in adults, and thoſe who have been inured to hard labour. The ſame has been alſo obſerved by Hippocrates[a], who ſays, *Corpora exercitata ac denſa citius à pleuriticis et peripneumonicis morbis pereunt, quam non exercitata*; "Strong bodies uſed to exerciſe periſh ſooner by "pleuretic and peripneumonic diſeaſes than thoſe "who are not uſed to exerciſe."

Diluting vehicle or juices.] When the moſt fluid parts of the blood are diſſipated in the beginning of acute diſeaſes, either by ſweats, a diarrhœa, or any other evacuation, there is always great danger of a fatal event. For the groſſeſt particles of the blood are not prevented from concreting or touching each other, but by the interpoſition of the more thin humours.

When blood is drawn from an healthy perſon, it appears an uniform fluid: but by ſtanding it diſſolves into two diſtinct parts: for the red globules unite and cohere, while the ſerum ſeparates from thence. But if blood newly drawn be ſtirred about with a ſtick till

[a] Coac. Prænot. 318. Charter. Tom. VIII. pag. 875.

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it is cold, the ſeparation of the ſerous from the red parts of that blood will be prevented, and the whole maſs will remain a fluid; from whence it appears how neceſſary a thin diluent liquor is to prevent a concretion of the blood. For this reaſon Hippocrates condemns a waſting of the more fluid parts of the blood by ſweats, a diarrhœa, &c. in the beginning of acute diſeaſes: for he ſays [b], *Sudor multus, cum febribus acutis obortus, malus. In febre ardente, ſi alvus affatim proruperit, lethale*; "That a profuſe ſweat "ariſing with acute fevers is bad;" [c] and "that a "profuſe diarrhœa is fatal in an ardent fever." It is alſo remarked by Sydenham [d], (who ſo diligently attended the endeavours of nature in the cure of diſeaſes,) that if the patient is infeſted with profuſe ſweats in the beginning of the ſmall-pox, all the ſymptoms are conſtantly augmented or rendered more violent.

If all or moſt of the circumſtances before enumerated, attend an inflammation, there is reaſon to hope it may be diſperſed without incurring any defect or morbid alteration; but this is not by diſcharging the morbid matter, nor by deſtroying the veſſels; but by opening the obſtructed veſſels, and rendering the impervious matter more fluid. But if ſome of the conditions before mentioned, as neceſſary to a reſolution, be abſent, we are then to endeavour to ſupply their deficiency by art. The humours are to be rendered mild by a ſoftening diet and medicines; the too great velocity of the circulation is to be quieted by bleeding, reſt, a cool air, &c. the veſſels of the affected part are to be relaxed by applying fomentations, that they may give way more eaſily to the obſtructing matter; a diluting vehicle is alſo to be ſupplied by a thin and watery drink, avoiding every thing at the ſame time which tends to drain off the moſt fluid

[b] Prorrhet. Lib. I. n°. 57. Charter. Tom. VIII. pag. 740.
[c] Coac. Prænot. n°. 130.
[d] Sydenham, Opuſc. Univerſa, pag. 321.

part

part of the humours from the body. But of all theſe we ſhall ſpeak more largely in the cure of an inflammation following.

SECT. CCCLXXXVII.

IF the circulating humour is mild, its motion rapid, the obſtruction great and incapable of reſolution (386); then the ſymptoms increaſing (382, 384, 385), the diſtended veſſels break with pain, heat, pulſation, and tumour; they extravaſate their contained humours, which are then diſſolved and gently putrified, and do themſelves break off and diſſolve the adjacent ſolids, which mix with the fluids, and form a ſimilar, white, thick, glutinous, and unctuous humour called pus or matter; and this, which is termed *ſuppuration*, is the ſecond way in which an inflammation is often terminated.

When the obſtructing particles are ſo firmly compacted in the extremities of the converging veſſels, that there is no paſſage afforded for the diluting vehicle to diſſolve and carry them into the veins; the increaſed motion of the fluids, acting behind, ſtill continues to force the obſtructing particles further into the more narrow parts of the veſſels; from whence it is evident, that at length the impervious matter will be moſt violently compreſſed, and ſtagnates without the leaſt motion in the obſtructed veſſel, from the narroweſt part of which it cannot be repelled towards the broader baſis. Therefore the whole length of this inflamed veſſel will be quite deſtitute of the vital influx of the humours, and therefore it will be neceſſary for it to ſeparate from the other living and ſound parts. Now we are aſſured from a diligent attention to nature in the cure of diſeaſes, that a ſuppuration

puration ſeparates every part, which was deſtroyed by the inflammation, from thoſe which are living and ſound: from whence it is evident, that a ſuppuration is not ſo much to be feared, except in thoſe parts of the body, whoſe continuity is abſolutely neceſſary for the maintenance of life and health; as for inſtance in the encephalon, or in a part where the matter cannot be ſafely extracted, as in a pleuriſy, *&c.* But in what manner all thoſe parts, which have been rendered unfit for receiving the vital motion of the fluids, are ſeparated by ſuppuration, may very well appear from what has been ſaid of this ſubject in the hiſtory of wounds; where we enumerated all thoſe appearances which are obſerved in an healthy body in every wound, from its firſt infliction to the completion of its cure, (ſee the commentary on § 158.) For in the firſt place the blood is extravaſated from the wounded veſſels, whoſe orifices contracting, then diſcharge only a thin and reddiſh ichor; the ſurface of the wound now appears almoſt dry, and a true inflammation ariſes from the vital motion of the humours urging againſt the obſtructed ends of the veſſels; as is evident from the pain, heat, redneſs, tumour, ſlight fever, thirſt, *&c.* In the next place the extremities of the impervious veſſels ſeparate, together with part of the impervious fluid impacted in the extremities of thoſe veſſels; whence ariſes a viſcid, white, and unctuous fluid, called pus or matter, upon the ſurface of the wound; and after a careful abſterſion of this matter, the whole ſurface of the wound appears evenly moiſt, which is an evident ſign that the veſſels, which were before obſtructed, are now opened by a ſeparation of their impervious and contracted extremities. A ſuppuration is therefore that ſalutary endeavour of nature, by which ſhe ſeparates from the other ſound and living parts every thing which is become unfit for receiving the vital circulation. Hence Hippocrates well obſerves, (ſee the paſſage cited § 158. numb. 7. and § 323.) that a wound inflicted by a ſharp inſtrument

ment may be cured without ſuppuration; but that contuſed and diſſected fleſh muſt putrify or waſte away by turning into matter. But although he here uſes the word putrify, when he treats of a ſuppuration; we are not therefore to underſtand ſuch a putrefaction as happens in a dead body, but a different kind of degeneration in the humours made by the life remaining. This has been very well diſtinguiſhed by Galen[a], where he treats of fevers; for he recommends urine that has a white ſediment, which is light and uniform, as a very good ſign, denoting that the matter of the diſeaſe is attenuated and evacuated from the body. But he calls this change in the urine a corruption, where he ſays, *Putredo autem humorum, quæ fit in vaſis, ſimilis eſt illi, quæ fit in inflammationibus et abſceſſibus et aliis tuberculis, &c.* "But the putrid ſtate, which the humours acquire "in the veſſels, is like that which happens in inflam- "mations, abſceſſes, and other tumours, &c. He likewiſe tells us there are two kinds of this corruption; *Alterum nempe fieri, vincente natura; alterum vero, devicta. Vincente quidem natura, uti in inflammationibus et tuberculoſis omnibus tumoribus pus fit; in humoribus autem arteriarum et venarum illud, quod ſubſidet in urina puri analogum. Hæc autem putredo non ſimpliciter putredo eſt, ſed aliquid coctionis habet. Manente enim concoquendi facultate vaſorum, putreſcens tunc humor ad talem alterationem deducitur*; Namely, "one of them which happens when nature over- "comes the diſeaſe; and the other when the diſ- "eaſe overcomes nature. When nature overcomes "the diſeaſe, there is a formation of matter like that "which is made in inflammations, and as happens in "all tumours; but that which ſubſides in the urine "reſembles matter, when in the humours of the arte- "ries and veins. But this kind of corruption is "not ſimply a putrefaction, but a kind of concoc-

[a] De Febribus, Lib. I. cap. 7. Charter. Tom. VII. pag. 115. et ibid. cap. 8. pag. 116.

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" tion or digeſtion; for while the digeſtive or atte-
" nuating power of the veſſels remains, the corrupt-
" ing humour is reduced to the ſtate abovementioned."
From hence it evidently appears, that the formation of matter is very different from a ſpontaneous putrefaction of the humours.

But the change of an inflammation to ſuppuration, when it is not reſolvable, ſeems to be performed in the following manner. The humours urge up on the back of the obſtructions, and enter the obſtructed veſſels at every contraction of the heart, with a velocity increaſed by the attending fever; from hence the ſides of the obſtructed veſſels will be gradually diſtended, and ſeparated from their coheſion with the extreme parts which remain obſtructed: but while this is performing, the humours are extravaſated from their ruptured veſſels, and being attenuated by the warmth of the parts, they enter into an incipient putrefaction and diſſolve both the impervious fluids, which heſitated in the extremities of the ſeparated veſſels, together with the tender ſolid parts, which before contained the obſtructing matter; all which being worked up together, attenuated and intimately mixed with the extravaſated juices, they receive ſuch a change by warmth and ſtagnation, that the whole forms a ſimilar or uniform fluid, called pus or matter. It may perhaps ſeem ſurprizing, that the ſolid membranes of the veſſels ſhould be thus diſſolved, and mixed with the juices, in ſuch a manner as to form a fluid which is uniform in appearance; but the difficulty will be removed, if we conſider the incredible tenuity of theſe ſmall veſſels. For it appears from the eſtimates made from the obſervations of Leeuwenhoeck and other learned men, that almoſt fifty millions of red blood globules, do but equal the weight of a ſingle grain [b]. But the ſmalleſt ſanguiferous arteries tranſmit only one ſuch globule at a time; from whence it is evident how ſmall and tender theſe vaſ-

[b] Medical Eſſays, Tom. ii. pag. 113.

cules muſt be: But theſe ſmalleſt ſanguiferous arteries are ſtill the largeſt among the ſmaller or decreaſing ſeries of thoſe veſſels. But we proved before, that a true ſanguine inflammation might be alſo ſeated in the ſerous and in the lymphatic arteries: Will it therefore any longer ſeem ſurprizing that the ſolid ſtamina, or threads of thoſe ſmall veſſels ſhould be thus diſſolved and mixed with the fluids ſo as to diſappear? We ſometimes obſerve in conſumptive people, that the whole ſubſtance of the lungs has been ſpit up in the form of matter, inſomuch, that upon opening the body after death, the phyſicians have with good reaſon wondered how life could be continued ſo long with ſo ſmall a part only of this important viſcus remaining.

That fluid which is formed of the extravaſated humours, and tender ſolids combined together, and mixed by attrition, is called pus or matter; which when laudable, or formed by a perfect maturation after an irreſolvable inflammation, has the following conditions: namely, it appears white, and almoſt of the thickneſs of cream, unctuous to the touch, and uniform in every particle, without any manner of foreign ſubſtance. But when matter has not theſe conditions, it is ſaid to be bad. All this has been remarked by Hippocrates [c], in his prognoſtics, where he ſays: *Pus autem optimum eſt album, & æquale, & læve, & minime fœtidum: quod autem maxime huic contrarium eſt, peſſimum eſt*; "But the beſt matter is "white, uniform, ſmooth, and the leaſt fœtid; but "matter which is the moſt contrary to this, is of the "worſt kind." And thus Celſus [d], in treating of what is diſcharged from the wounds and ulcers; namely concerning blood, foul matter, and ichor, *&c.* ſays: *Pus inter hæc optimum eſt. Sed id quoque pejus eſt, multum tenue, dilutum; magiſque, ſi ab initio tale eſt: itemque ſi colore ſero ſimile, ſi pallidum, ſi lividum,*

[c] Sentent. 42. Charter. Tom. VIII. pag. 617. [d] Lib. V. cap. 26. n. 20. pag. 289.

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ſi fœculentum. Præter hæc ſi male olet; niſi tamen locus hunc odorem excitat. Melius eſt, quo minus eſt, quo craſſius, quo albidius: itemque ſi læve eſt, ſi nihil olet, ſi æquale eſt; "Among theſe, pus or matter is "the beſt. But of this the worſt kind is that "which is very thin and dilute; eſpecially if it "was ſo from the beginning: and it is alſo bad, "when the colour of it is like ſerum, pale, li-"vid or fœculent. To which add an ill ſmell, ex-"cept it is derived from the part. The matter is "the better, as it is leſs in quantity, thicker and "whiter; appearing alſo ſmooth and uniform, with-"out any ſmell." A little afterwards he well obſerves, that the matter being formed, terminates the inflammation: for he ſays, *Modo tamen convenire & magnitudini vulneris & tempori debet. Nam plus ex majore, plus nondum ſolutis inflammationibus naturaliter fertur.* "That the matter ought alſo to be agreeable "to the magnitude and the age of the wound; for "more matter is naturally diſcharged from a larger "wound, and more before the inflammation is gone "off." Now when the inflammatory matter is too ſtubborn or compact to be digeſted into pus; or when the concocting powers are weaker than is neceſſary for that purpoſe, or when both of theſe concur together; then there is not a matter formed as above conditioned, but the fluid produced deviates more or leſs from thoſe conditions, as Galen [a] well obſerves, in his explanation of the text of Hippocrates laſt cited. For after having ſaid, that the blood is transfuſed in a phlegmon into the void ſpaces near the veſſels (that is into the cellular membrane,) he ſays it cannot then return to its former ſtate, but will change and putrify in the ſame manner as all other juices do, which are violently heated in ſome foreign part; and he then adds: *Itaque ſi innatus calor a propria temperie plurimum receſſerit, ſanguis, ut in cadavere, putreſcit. Si autem ille adhuc aliquam vim retinet, mixta quædam*

[a] Comment. 1. in prognoſt. Hip. Charter. Tom. VIII. pag. 618.

ſanguinis mutatio fit; partim quidem ab ea, quæ præter naturam, partim vero ab illa, quæ ſecundum naturam cauſa eſt; quarum ut illa, præ præter naturam eſt, putrefacit; ſic illa, quæ ſecundum naturam eſt, cauſa concoquit. Earum vero utravis prævaluerit, protinus indicia, tum in colore, tum in odore, tum in conſiſtentia, neceſſaria conſequuntur; "So that if the innate heat "is too low, or deviates much from its proper tem- "perature, the blood then putrefies as in a dead "body. But if it as yet retains ſome force, the "blood then undergoes a kind of mixed alteration, "partly from the deficiency of nature, and partly "from that power which ſhe yet retains; and there- "fore there follows a putrefaction of that which is "preternatural, and a concoction of that which is "agreeable to nature. But which of theſe condi- "tions prevails moſt, may be known from the ne- "ceſſary conſequences or ſigns which immediately ap- "pear both in the warmth, in the ſmell, and in the "conſiſtence of the matter.

The formation of matter therefore depends on, or reſults from the remaining health; whence it is juſtly reckoned by Hippocrates[f] among the worſt ſigns of diſeaſes, for an ulcer to become dry, and diſcharge no more matter either before or in a diſeaſe; for he pronounces that ſuch a patient cannot long ſurvive.

But that the inflamed part tends to ſuppuration, is known from the following circumſtances.

If the circulating humour is mild.] For if there is any conſiderable acrimony in the humours, it will be ſtill much more increaſed by the ſtagnation and greater heat of the inflamed part; from whence would follow an eroſion and deſtruction of the veſſels, inſtead of that mild ſuppuration of their obſtructed ends only, which happens in a ſuppuration.

[f] Hippoc. prognoſt. Sentent. 22. Charter. Tom. VIII. pag. 605. & Coac. prænot. n. 496.

Its

Its motion ſwift.] In the reſolution of an inflammation, a ſedate motion of the humours is equally neceſſary with their mildneſs; but when a ſuppuration follows there is always a greater velocity of the circulation: Whence a ſuppuration ſeems to be a ſort of medium betwixt a reſolution and a gangrene. In a reſolution, the concreted or ſtagnating humours are removed and reduced to their former ſtate of fluidity; without offering any further injury to the veſſels, or making any evacuation of the impervious juices: but in a gangrene, there is a true death of the inflamed part, which muſt therefore be ſeparated afterwards from the adjacent living veſſels. Now, in a ſuppuration, the ends only of the obſtructed veſſels are ſeparated or thruſt off, and mixing with the extravaſated humours, are formed into matter, under which appearance they are to be diſcharged; and in this a ſuppuration differs from a reſolution; but from a gangrene it differs, in as much as a ſuppuration does not deſtroy all the parts affected. Hence, therefore, the particular velocity of the humours through the part, as well as that of the whole maſs in general, which accompanies an inflammation, ought to be very ſedate, to afford any hopes of obtaining a reſolution: and, on the contrary, it is evident, that if a violent fever attends, a gangrene muſt ſoon follow; but if the motion is not ſo ſedate as in a reſolution, nor yet ſo ſwift as is uſual in a gangrene, the inflammation muſt then terminate in an abſceſs or ſuppuration. When there are no hopes of obtaining a reſolution, it may be as pernicious to leſſen the fever too much, as too imprudently render it more violent; as will appear more evidently hereafter, in the commentary on § 403. numb. 3.

The obſtruction large, &c.] In what reſpect an obſtruction is to be termed large or ſmall, as alſo what ſigns there are denoting its reſolution, has been already declared under the preceding aphoriſm. But an inflammation is principally known to tend to a

ſuppuration by the increaſing of the tumour, heat, pain, redneſs, and other ſymptoms enumerated in the aphoriſms here cited; but theſe ought not to increaſe very ſuddenly, for then they rather threaten a gangrene, but they ſhould rather make a conſtant and gradual increaſe. It would perhaps be a difficult matter to know exactly the bounds, where the poſſibility of a reſolution terminates, and where an incipient ſuppuration begins; but this is certain, that the pain, pulſation, fever, heat, *&c.* do manifeſtly increaſe at the time when the inflamed part ſuppurates. But when the ſuppuration is finiſhed, all thoſe ſymptoms are again diminiſhed, as Hippocrates [f] very well obſerves, where he ſays: *Circa puris generationes dolores & febres magis accidunt, quam pure facto*; "That the "pain and fever are more intenſe about the time of "the formation of matter, than when the matter is "quite formed." Nor is this at all ſurprizing, ſince the diſtended veſſels muſt excite the moſt acute pain at the time when they are neareſt to a rupture; but when they are once broke, the pain thence ariſing immediately ceaſes. See § 221.

SECT. CCCLXXXVIII.

IF the humour is acrimonious, violently moved, the obſtruction large, and the veſſels rigid, then all the ſymptoms (382, 386, 387) are violent; and the ſmall veſſels ſuddenly burſting open, their juices become putrified; hence an ichor is extravaſated and collected like the waſhings of fleſh in bliſters under the cuticle, or elſe there appears a yellow, pale, aſh-coloured, brown, or black coloured foul matter: in the mean time, the redneſs, pain, heat, pulſation, and tumour leave the affected parts, and invade

[f] Aphor. 47. Sect. 2. Charter. Tom. IX. pag. 85.

thoſe

thoſe which are adjacent, whereupon follows a death of the part affected, which is termed a *gangrene*; being the third manner in which an inflammation ſometimes terminates.

We come now to the third manner in which an inflammation terminates, which is called a *gangrene*. When the vital circulation of the humours through the arteries and veins is from any cauſe deſtroyed in ſome ſoft part of the body, it occaſions a death of that part; which while beginning and performing, is termed a gangrene. Therefore this manner of terminating an inflammation differs from a ſuppuration, in as much as all the motion of the humours is intirely deſtroyed in the affected part, by a ſudden rupture of its ſmall veſſels; whereas in a ſuppuration, only the extremities of thoſe veſſels are gradually ſeparated, by the motion of the vital humours urging behind. But an inflammation more eſpecially tends to a gangrene, when attended with the following circumſtances.

If the humour is acrimonious.] Any very ſharp ſubſtance or liquor applied externally to the body, cauſes a gangrene, whether it be acid, alcaline, or of any other ſpecies of acrimony. For thus true gangrenous eſchars are formed, by touching the ſkin either with oil of vitriol, the potential cautery of the ſurgeons (formed of a ſharp alcaline ſalt, boiled up with quick lime) the acrid empyreumatic oils of hartſhorn, of lignum guaicum, the volatile alcaline ſalts, *&c.* and the ſame thing alſo happens when the maſs of blood itſelf is infected with acrimonious particles. It is indeed true, that theſe acrimonious particles cannot eaſily enter into the blood; and yet we obſerve in diſeaſes, that the humours often degenerate ſurprizingly into an acrid ſtate, by which the ſoft parts are often ſuddenly corroded and deſtroyed. In the worſt ſpecies of the ſcurvy the gums are often de-

ſtroyed by a true gangrene or putrefaction, with an intolerable ſmell; and the moſt malignant ulcers, ſuddenly tending to a gangrene, ariſe in various parts of the body and eſpecially in the legs. And the like diſaſters are alſo obſerved to follow from a turgeſcence of the veſſels with atra-bilis joined with a violent motion, as we ſhall explain more at large in § 1104. From whence it is evident, that if a conſiderable acrimony of the blood is alſo accompanied with an inflammatory ſpiſſitude or tenacity, that then the veſſels muſt be ſuddenly deſtroyed, and a gangrene produced.

Violently moved.] We have already ſeen, that a ſedate motion of the humours favours the reſolution of an inflammation, and that a motion more ſtrong or ſwift alſo promotes a ſuppuration; but a motion ſtill more violent will act ſo forcibly upon the obſtructed ends of the ſmall arteries, as to break them all open ſuddenly, and not produce a gradual ſeparation of them, as is done in a ſuppuration. But a ſwift motion of the circulating humours throughout the whole body, is known by the quickneſs of the pulſe, and frequency of the reſpiration; while the moſt intenſe pain and heat alſo denote the ſame thing in the inflamed part. If then an acrimony of the humours be added to their increaſed motion, it is very evident, that theſe very fine veſſels muſt be very ſpeedily deſtroyed; ſince the humours are in this caſe applied not only with an acrid or diſſolving power, but alſo with a greater impetus, and oftner in a given time. It was alſo demonſtrated in the commentary on § 100. that a bare increaſe of the circulation, renders the ſalts and oils of the blood more acrimonious; and from hence again will ariſe a new ſtimulus, increaſing the velocity of the circulation, ſo as to be ſtill more productive of itſelf. From all which it is ſufficiently apparent, what danger an inflamed part is in, when there is a violent fever attends.

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The veſſels rigid.] It was demonſtrated in the commentaries on § 52. that an increaſed rigidity or too great a ſtrength of the veſſels rendered the blood very thick or compact, and diſſipated its more fluid parts, by which means it became more inclined to concretion. And we lately obſerved (§ 386.) that a mobility of the flexible veſſels, and a diluting vehicle, are two of the chief means from whence we are to expect that inflammation may be reſolved: and therefore if the contrary of theſe take place, they will be always followed with more fatal conſequences. As in this caſe the humours move through the veſſels with a great velocity, their whole impetus will act upon the ends of the obſtructed veſſels, a great part of which impetus would have been otherwiſe ſpent in dilating the ſides of the flexible veſſels; and from hence the ends of the veſſels will be ſuddenly forced or broke off by this greater impulſe or more ſudden action of the humours upon the obſtructed matter; whence will be occaſioned all the conſequences hereafter enumerated. And from hence the reaſon is alſo evident, why inflammatory diſeaſes are generally ſo fatal in people who have been addicted to hard labour.

Then all the ſymptoms are violent.] If the tumour of the inflamed part ſuddenly increaſes, the redneſs becomes intenſe or inclines to a purple, the heat burning, and pain ſevere or continually increaſing, accompanied with a quick pulſe and a difficult reſpiration, *&c.* a gangrene will then follow in a little time.

The veſſels are ſuddenly broke, *&c.*] If now we conſider that an acrid humour is here violently impelled againſt the ends of the veſſels, ſo obſtructed with impervious matter, that they are quite incapable of tranſmitting any part; it will readily appear, that we ought to expect a ſudden rupture or diſſolution of thoſe veſſels, and this eſpecially if the too great rigidity of the veſſels renders them leſs apt to be diſtend-

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ed without breaking. The veſſels once broke, they extravaſate their juices, which ſpontaneouſly corrupt, and that in a little time, ſince the intenſe heat, which always accompanies a violent inflammation, very much promotes putrefaction, as was ſaid before at § 84. numb. 5. But while all this is performing in the inflamed part, there are certain ſenſible alterations to be obſerved, which teach us, that a gangrene is already preſent, or will very ſuddenly follow. But all theſe appearances are perfectly like thoſe which ariſe from the application of fire to any part of the body, as we obſerved in the commentary on § 370. For then the cuticle begins to ſeparate from the ſubjacent ſkin, and becomes elevated into bliſters by the extravaſated humours, which bliſters are generally filled with a reddiſh coloured ichor, or in a worſe ſtage of the diſorder with a thin yellow matter: hereupon the ſhining redneſs of the part changes into an aſh, pale brown, or even at length into a black colour; and the diſorder is known to have made a greater or leſs progreſs, in proportion as the colour inclines from that of a pale aſh to blackneſs. Hereupon all the ſymptoms of inflammation diminiſh, and ſometimes they ſeem entirely to diſappear; nor need we wonder at this, ſince the inflammation ariſes from an increaſed velocity of the humours from the vis vitæ which remains. Hence the redneſs diſappears, and the blood is no longer impelled through the veſſels of the part affected; and ſince for the ſame reaſon the nervous fibres of the veſſels are no longer diſtended, the pain alſo ceaſes. Since the heat and pulſation ſuppoſes a violent attrition betwixt the impelled fluid and the ſides of the veſſels, therefore they alſo diſappear when a gangrene follows upon an inflammation; and hence a ſudden ceſſation or remiſſion of the pain and other ſymptoms in acute inflammatory diſeaſes is juſtly eſteemed fatal, if the proper ſigns have not firſt preceded. For when a gangrene ariſes after a violent inflammation in ſome external part of the body, it is

eaſily

eaſily apparent from the forementioned ſigns, whether the diſorder is preſent; but when the internal parts of the body ſuffer the like diſorder, a ſudden ceſſation of the pain affords the principal ſign of the gangrene. Thus in the moſt violent pleuriſy, and moſt painful inflammation of the inteſtines, the acute pain often ſuddenly goes off, and the patient periſhes ſoon after he imagined the diſorder to be overcome. Theſe are the fallacious changes in the worſt diſeaſes, which often prove prejudicial to the character of a phyſician; for being thus deceived, he imprudently preſages a happy event of the diſeaſe, which yet proves fatal in a little time.

The veſſels being therefore deſtroyed, all the vital influx and efflux of the humours into the affected part will be aboliſhed, that is, a death of the part follows, and then all the conſequences of a ſpontaneous corruption of the mortified part ſoon follow. If we look into thoſe changes which are made in the fleſh of animals lately killed, and expoſed to a warm air, they will appear to be almoſt the ſame with what we obſerve in gangrenous parts. For the lively red colour of the fleſh begins firſt to diſappear; a pale aſh colour, gradually inclining to brown, ſucceeds; and at length the putrefying fleſh turns almoſt black, and forms a ſtinking matter, which was but a little before ſolid fleſh: but all theſe ſymptoms happen ſooner in the gangrenous part, as the warmth of the adjacent living parts increaſes the putrefaction of thoſe which are mortified.

But the adjacent parts which are not dead, having their humours as yet pervious, thoſe humours will be obſtructed in the borders of thoſe parts which interpoſe between the dead and the living, being incapable to paſs through the part which is already dead: and from hence a new inflammation ariſes as it were round the gangrene, after which a ſuppuration following, the dead or gangrenous parts are ſeparated from the living, or elſe the gangrene ſpreads into the contiguous

tiguous parts by the deſtruction of the vital motion of their humours. But what has deceived ſome unwary phyſicians, is their believing the part to be not yet gangrenous, becauſe there is a pain ſtill perceived in it; though properly ſpeaking there is not any ſenſation in the gangrenous part, but a pain ariſes only in thoſe ſubjacent or ambient parts which are yet living and inflamed. But it is always eſteemed a good ſign if the whole compaſs of the gangrenous part appears red, painful, hot, tenſe, *&c.* provided the ſymptoms are not ſo violent as to turn the inflammation into a gangrene: for we then know, that the life remaining in the reſt of the body, endeavours to ſeparate the gangrenous or corrupted from the adjacent living parts.

SECT. CCCLXXXIX.

WHEN a part thus affected (388) is compreſſed externally, or the intenſe heat diſſipates much of the moiſture, then the dead part is indurated and dried up like leather, otherwiſe the ſubjacent parts, being deſtitute of the circulation, corrupt.

Now in the part where the gangrene is ſeated, there is no motion of the humours through the veſſels, but a mere reſt or ſtagnation of them, from whence the ſame changes follow there, as happen from the ſame cauſes in a dead body. The heat of the living ſubjacent parts, being alſo accompanied with a moiſture, converts all that is mortified into a putrid matter; but if their moiſture is exhaled either by intenſe heat or external compreſſion, then the part mortified is dried up and hardened perfectly like a black and dry ſkin or leather, being frequently ſo tough as to be ſcarcely diviſible by a razor. But this is chiefly obſerved in the external parts, which are covered with the

the ſkin; for in other parts the gangrene rather diſſolves them into a putrid matter. Thus I ſaw the inteſtines were converted into a putrid matter within the ſpace of two days time, in a man who died of an incarcerated rupture, though the man was before in health, and the diſeaſe continued for no longer a time. But when a gangrene ariſes in acute diſeaſes about the os ſacrum and coccyx, from the patient's lying too long on his back, there appears then very black and dry ſpots in the affected ſkin. But how ſuddenly a gangrene may ariſe, and the ſkin grow black and hard like leather, even in an healthy perſon, barely by an external compreſſion, may be learned from the following accident. While two carpenters were preparing the vaſt body of a tree, in order to make it into the axis of a mill, in turning it round, it unfortunately happened to give way while it was elevated by the hand-ſpikes, and by its weight it threw both the men into the adjacent pit, where one of them was inſtantly preſſed to death by the weight of it, and the other was obliged to ſuſtain the weight of it, for above half an hour lying upon the ſpine of the tibia of his left leg. By good luck the bottom of the pit was covered with a good deal of ſoft mud, which prevented the preſſure from doing ſo much injury as it otherwiſe might; ſo that the man returned home joyfully, without being much damaged, being able to ſtand and walk upon his legs for above a quarter of an hour without detriment: but I being called on the next day, found many large and ſmall black ſpots in the anterior part of the leg, where the os tibiæ has its ſurface covered almoſt with nothing but the integuments, and theſe ſpots reſembled a withering or deadneſs ariſing from contuſion; but after a more ſtrict examination the ſkin of thoſe parts appeared very black and hard like leather. For the rough ſurface of the beam had ſo compreſſed the ſkin by its weight againſt the ſubjacent bone, that it became quite deſtitute of all the vital influx and efflux

of

of its humours; and afterwards all thoſe dead parts were ſeparated by a ſuppuration formed all round their margins. Here I had a fair opportunity of ſeeing what a bare compreſſion was capable of effecting, and of ſeeing the reaſon why thoſe parts of the ſkin ſo ſoon mortify ſometimes in diſeaſes, upon which almoſt the whole weight of the body is ſupported when a perſon lies long in bed. But when this hard part of the ſkin like leather is preſſed againſt the ſubjacent living parts, they are inflamed, ſo much tumified, and likewiſe compreſſed, (if the horny matter cannot be ſeparated from the living parts to which it adheres,) that the diſorder by that means ſpreads itſelf deeper.

SECT. CCCXC.

THIS change of an inflammation into a gangrene (388) is ſpeedily promoted by the uſe of every thing which is actually or potentially cold, which aſtringe, coagulate, or repel; alſo ſuch as are fat and acrimonious, emplaſtic or narcotic, ſtrong ligatures or an external compreſſion.

This aphoriſm enumerates thoſe things, which, being applied to the inflamed parts, are found to cauſe a ſudden change of an inflammation into a gangrene.

Things actually or potentially cold.] Among thoſe cauſes, which diſpoſed an inflammation to turn to a gangrene, we enumerated a large obſtruction and a rigidity of the veſſels, ſee § 388. but the effects of cold are a greater contraction and ſtrength of the ſolids, and to increaſe the imperviouſneſs of the fluids. The moſt intenſe cold will therefore quite intercept the circulation of the humours by congealing them, and by contracting the veſſels; whence a ſudden mortification of a part often follows from a ſevere froſt: but when the vis vitæ is capable of removing the obſtructions

ſtructions in the frigid part, then an intenſe heat ariſes from an attrition of the more condenſed humours through their contracted veſſels; which laſt is a thing frequently experienced by thoſe who have been rubbing their hands with ſnow, when the uneaſy ſenſe of cold is ſoon followed with an intenſe heat. From hence it is evident, that the application of cold things to an inflamed part muſt be prejudicial, inaſmuch as they either totally intercept the circulation, or inaſmuch as they excite a more intenſe heat afterwards in the parts which are already too hot. But ſometimes the application of cold things may be ſerviceable, when the groſſer parts of the humours have entered the ſmaller veſſels by an error of place, as the veſſels, being contracted by the cold, may repel the matter back into the larger branches; and this more eſpecially when the diſorder is ſeated in the thinner humours, ſince the red part of the blood immediately congeals in cold water, but the ſerum and thinner lymph does not. But it is eaſily apparent, that no good can be expected from the application of cold things, when the diſorder is recent and at the ſame time mild; for if the obſtructing matter of the inflammation is ſo impacted in the ſmalleſt extremities of the veſſels as to be quite ſtagnant, the diſorder will be then rather increaſed. But all this is exactly agreeable with the doctrine of the antients. Thus Hippocrates[a], after having in two places obſerved, that cold, among other evils, produces gangrenes or blackneſſes, (μελασμὸς) he ſoon afterwards adds, that it may be ſometimes ſerviceable, and enumerates the uſes of cold things: [b] *ſi inflammationes & ardores in rubrum & ſubcruentum vergant ex recenti ſanguine. Inveteratas enim (inflammationes) denigrat. Et eryſipelas non ulceratum juvat, ulceratum vero lædit*; "That "they may be ſerviceable when inflammations and "heats incline to a red or blood colour from recent

[a] Aphor. 17. & 20. Sect. V. Charter. Tom. IX. pag. 204, 205.
[b] Ibid. Aphor. 23. pag. 208.

"blood.

" blood. But cold turns inveterate inflammations to " a gangrene or blackneſs. It is alſo ſerviceable in an " eryſipelas which is not ulcerated; but it injures one " which is ulcerated." And though Galen[c] recommends the uſe of coolers in a phlegmon, he yet adds ſome good cautions, when he ſays, *Magiſque profecto ad incipientes phlegmonas frigidis & adſtringentibus, quam diſcutientibus, eſt utendum: atque etiam magis, ubi craſſum non eſt, quod confluit. Vehementi enim in parte inflammata incuneatione* (σφηνώσεως) *facta, non eſt amplius repercutientibus utendum, ſed tunc tempeſtivum eſt diſcutere*; " And in truth coolers and aſtringents are ra- " ther to be uſed to incipient phlegmons than diſcu- " tients; and this more eſpecially when the obſtruct- " ed matter is not groſs or thick: for when the ob- " ſtructing matter is wedged into the veſſels of a " part violently inflamed, there is no more opportu- " nity to uſe repellents, but then it is time to pro- " cure a diſcuſſion." They certainly could not have ſaid better, if they had underſtood the nature of an inflammation from the preſent known laws of the circulation. And in another place, in treating on the cure of an eryſipelas, Galen obſerves[d], that this diſorder requires more cooling than a phlemon; and then he adds, *Eſto autem refrigerationis terminus coloris mutatio. Etenim exquiſitum eryſipelas ſtatim cum hac quieſcit: non exquiſitum vero, ſed quodammodo phlegmonodes, ſi pluſculum refrigeris, lividam cutim facit. Si ne ſic quidem quis deſiſtat, nigreſcit, & potiſſimum in ſenilibus corporibus: ſic ut quædam ita refrigeratorum ne quidem diſcutientibus medicamentis perfecte ſanentur, ſed relinquant ſcirrhoſum quemdam tumorem in parte, &c.* " But let the uſe of coolers be determined by the " change of colour in the part: for by this means a " true eryſipelas ſoon goes off; but it is not ſo if you " cool a little too much, ſo as to make the ſkin li- " vid in an eryſipelas which is not a true one, but in

[c] Galen. Meth. Med. Lib. XIII. cap. 6. Charter. Tom. X. p. 301.
[d] Ibid. Lib. XIV. cap. 3. Ibid. pag. 320.

" ſome

" ſome meaſure phlegmonode. For if a perſon does " not then deſiſt, the part turns black, and this eſpe- " cially in old people: inſomuch that the parts, which " have been thus refrigerated, cannot be then perfect- " ly cured, even by the uſe of diſcutient medicines, " without leaving a kind of ſcirrhous tumour be- " hind," &c. From whence it is ſufficiently evident how precarious and uncertain it is to uſe coolers for the cure of inflammations, ſince they are by that means ſo eaſily converted into worſe diſeaſes, if they are not uſed in the very beginning of the diſeaſe, or in thoſe caſes where the inflammation ariſes from an error of place, not of the red blood, but of the thinner humours; as for inſtance in the eryſipelas, the œdema callidum, and the like.

Things called actually cold are thoſe which remove or diminiſh the heat of an healthy body to which they are applied, even though the things themſelves were actually warm, or at leaſt not much colder than the part itſelf of the body to which they are applied. They are therefore ſuch things as either diminiſh or totally remove the cauſes of heat in the part. But heat ariſes from the motion of the fluids through the veſſels; which motion being diminiſhed, the heat decreaſes, and the reverſe: whence it is evident that thoſe things are ſaid to be potentially cold, which either remove or diminiſh the ſtrength and velocity of the circulation. Thus warm water applied to an inflamed part may remove or diminiſh the too intenſe heat, by relaxing the veſſels, and diluting the obſtructing particles: from whence it may be ſaid to be potentially cooling, notwithſtanding it is actually warm. But it is very evident, that theſe and the like potentially cooling remedies are ſeldom prejudicial to inflammations; as will be ſtill more evident, when we come to the cure of an inflammation. For theſe laſt do not deſtroy the motion of the humours through the veſſels, but they reſtore the equality of the circulation by removing the obſtructions; whereas

thoſe, which cool by intercepting the vital circulation, are highly pernicious, which we are told are the conſequence of ſome poiſons. Thus when Socrates had drank the juice of the cicuta, he felt his legs grow cold, and that coldneſs aſcending above the pubes, he preſently expired.

Which aſtringe or coagulate.] For by theſe the capacity of the veſſels is dimiſhed, and their humours are rendered impervious; both which conſequences tend to increaſe the cauſes of the obſtruction; they therefore deſtroy the free motion of the fluids through their veſſels, which when totally aboliſhed, forms a preſent gangrene in the part.

Repel.] The inflamed part tumifies, and that often to a great degree, for the reaſons before mentioned at § 382. numb. 1, 2. from whence the antient phyſicians concluded, that a matter was here accumulated, which was not there before, and which muſt therefore have been derived from other parts. Now as they obſerved that this accumulation was often made very ſuddenly, they judged it aroſe from an afflux of humours; and therefore placed the cure of the diſorder in repelling them, eſpecially towards the beginning of the diſeaſe, as was a little before proved under the ſame aphoriſm in the paſſage quoted from Galen. That ſuch a repulſion of the blood from the ends of the arteries towards their baſes is practicable, is evident from the moſt certain obſervations. The moſt healthy perſon, who is ſuddenly ſtruck with fear, has inſtantly a paleneſs of his face and lips, which denotes that the red blood is repelled towards the heart and larger veſſels; and therefore a palpitation of the heart with anxiety ſoon follow this paleneſs. The ſame alſo manifeſtly happens when a perſon faints away. But the particles of the blood, which are repelled in theſe caſes, may be alſo repelled from the ſmaller into the larger veſſels by the ſame action when they have miſtaken their courſe, and thus may the obſtruction be reſolved. But how far this may be

ſerviceable,

ſerviceable, was declared a little before, when we treated of the application of coolers to inflamed parts: but as all thoſe things, which are externally applied to cauſe this repulſion, act by contracting the veſſels, it is very evident that their uſe muſt be dangerous, except in the beginning of an inflammation ariſing from an error of place; and that therefore if they do not immediately prove ſerviceable, the diſorder will by that means be increaſed.

Such as are fat and acrimonious, or emplaſtic.] Concerning theſe ſee what has been ſaid in the commentaries on § 376. For ſince theſe are of themſelves ſufficient to produce an inflammation, they will doubtleſs increaſe an inflammation ariſing from other cauſes, eſpecially if they adhere to the affected part by an emplaſtic tenacity; for then they render the part affected leſs perſpirable, and the mixt acrimony will remain a long time fixed to the part.

Narcotic.] Theſe perhaps are in their own nature not ſo much to be condemned, eſpecially if they are prudently applied. But as all theſe only obtund the ſenſe of pain, leaving its cauſe remaining; therefore the inflammation often increaſes every minute, and a gangrene follows by a deſtruction of the veſſels, without giving us any intelligence by the ſenſe of pain. But an acute pain, heat, pulſation, and the other ſymptoms ſufficiently advertiſe both the patient and the phyſician of the ill conſequences which are to be feared or expected, unleſs they are deceived by removing the ſenſe of pain by the uſe of narcotics; whence in ſuch a caſe the moſt efficacious remedies are neglected, which might have prevented this termination of the inflammation in a gangrene.

Strong ligatures.] In what manner a gangrene may ariſe from hence, has been declared in the commentaries on § 355. But it is very evident, that if a part already inflamed is compreſſed by a ſtrong ligature, the ſame diſaſter is to be expected much ſooner.

An external compreſſure.] Of this we treated under the preceding aphoriſm.

SECT. CCCXCI.

AND all theſe cauſes likewiſe haſten a gangrene into a ſphacelus.

It was demonſtrated in the commentaries on § 374. that a true phlegmon is moſt frequently ſeated in the cellular membrane, which it ſometimes diſtends to an immenſe bulk: inſomuch that the thin cellular membrane upon the back of the hand is ſometimes ſwelled to the thickneſs of two or three inches above the reſt of the ſkin. When therefore a gangrene follows an inflammation ſeated in this part, the whole corrupted maſs muſt be afterwards ſeparated. And it is no uncommon thing for one to be able to enter the ſcalpel to a conſiderable depth without any ſenſe of it, which might occaſion one to believe that all the ſubjacent parts are dead. But it very frequently happens, that the ſubjacent tendons and muſcles are living nevertheleſs: and then the gangrene is not yet become a ſphacelus: for in this laſt diſorder all the incumbent parts are mortified even to the bone, as we ſhall declare hereafter in the commentary on § 429. But when the panniculus adipoſus is ſo much diſtended, already invaded with a gangrene, and in the mean time confined by the tough ſkin, it will compreſs all the ſubjacent parts, and therefore the vital circulation may be hence intercepted even in theſe; and then the gangrene paſſes into a ſphacelus or perfect mortification of the part. Every thing therefore which has been enumerated in the preceding aphoriſm, as capable of turning an inflammation into a gangrene, may alſo increaſe a gangrene, ſo as to become a ſphacelus.

SECT.

SECT. CCCXCII.

IF the inflamed part is glandular, the internal or external heat great, the obſtructing matter thick and inactive by obſtructing the emunctories of the glands, and by diſtending their follicles or cells, and their ſides or membranes, it produces a hard indolent tumour of a gland, which is called a *ſcirrhus*, and is the fourth manner in which an inflammation terminates.

We come now to the laſt way of terminating an inflammation; namely, when an inflammation is not reſolved, nor the obſtructed parts ſeparated from thoſe adjacent which are ſound: in which caſe therefore the morbid will remain united to the ſound parts in ſuch a manner, that no future endeavour of nature, nor any of the preſent known aſſiſtances of art, can diſſolve it; but it can be no otherwiſe removed, than by the knife or by fire. But in thoſe parts of the body, in which the blood paſſes every moment with a rapid motion through the veſſels, it is evident, that the obſtructed matter cannot long remain without ſome alteration: for by this continual ſtruggle betwixt the impulſe of the blood and the re-action of the veſſels, either the obſtructing matter will be removed, digeſted into laudable matter by ſuppuration, or elſe corrupted in a little time ſo as to form a gangrene or a ſphacelus. But when ſuch is the ſtructure of the affected part, that the arterial blood paſſes through its veſſels with little or no force, then there is danger leſt the obſtructing matter, being gradually deprived of its more fluid parts, will remain there immoveable, and form a hard indolent tumour which we call a ſcirrhus. But this way of terminating an inflammation is moſt frequently obſerved in the glandular parts, whoſe emiſſaries or excretory ducts being

obſtructed, none of the ſecerned juices ſeparated by the fabric of the gland, can eſcape, and theſe therefore being accumulated and inſpiſſated by ſtagnating in the cavities, or in the vaſcular compages, will fill and diſtend them: and as the circulating humours cannot here exert their impulſe upon this impacted matter, it will there remain deprived of its more fluid parts, and form an induration or ſcirrhus, of which we have a notable inſtance in an inflammation of the breaſt. For the milk ſeparated from the blood, brought by the mamillary arteries, and ſtagnating in the lactiferous ducts, begins to coagulate; in the mean time the thin ſerum diſtils from the ducts of the nipple, and the reſiduum remains inſpiſſated, and in a manner out of the courſe of the circulation; whence after the inflammation is gone off, ſuch a hard indolent tumour often remains, during the reſt of the patient's life. From hence likewiſe a ſcirrhus of the teſticles often follows, after an inflammation of them: for if we conſider that the very ſmall ſpermatic artery, which ariſes from the trunk of the aorta, ſends out ſmall branches, which communicate and tranſmit the red parts of their blood by real anaſtomoſes into ſimilar ſmall veins, and then ſpends itſelf in an infinite number of convoluted ſmall branches placed orderly, and compoſing the ſubſtance of the teſticle; it will evidently appear from thence, that the impulſe of the arterial blood upon the obſtructed veſſels, is here little or nothing; whence the obſtructing matter being once impacted or fixed in theſe glands, it proves very ſtubborn, and forms a tumour inflexible to all means whatever. But a ſcirrhus follows an inflammation in a glandular part, more eſpecially when attended with the following circumſtances.

A great heat whether external or internal.] Women in childbed often commit the cure of their inflamed breaſt to their nurſes, or to ſome old woman, who is often crazy enough; and as they fear nothing more than a ſuppuration, and an opening of the ſuppu-

rated

rated part by the ſurgeon's lancet, they therefore uſe all their endeavours to prevent it. If indeed they endeavoured to diſperſe the inflammation in time by the application of emollient fomentations, they could not be much blamed: but, on the contrary, they, by a dangerous error, expoſe the inflamed breaſt to the heat of a burning coal, or elſe continually foment it with very dry and hot linen cloths, or elſe they apply ſpirit of wine almoſt ſcalding, by which means, inſtead of a ſuppuration following, the more fluid parts are exhaled, and the reſt of the matter inſpiſſated into an irreſolvable ſcirrhus; and then the unhappy woman who was ſo much afraid of a ſlight puncture with a ſharp lancet, is frequently obliged afterwards to undergo the very ſevere and dangerous operation of amputating. The ſame diſorder alſo frequently follows from the ſame cauſes, when the inflammation of a glandular part is accompanied with a violent fever.

The obſtructing matter thick and inactive.] Since milk contains ſo large a quantity of a thick cheeſe like craſſamentum, which eaſily ſeparates by ſtagnation from the thinner ſerum by which it was diluted; therefore a ſcirrhus more frequently happens in the breaſt, than in any other part. When the fœculent or groſſer parts of the blood are deprived of their more fluid juices, conſtituting what the antients call atra-bilis, which infects the maſs of humours almoſt with the tenacity of pitch, in that caſe the ſlighteſt obſtruction in glandular parts degenerate into ſcirrhi, as we ſhall declare hereafter in the commentary on § 485.

Obſtructing the emunctories of the glands, &c.] All thoſe juices which have been ſecerned by the fabric of the gland from the affluent blood, ought to be diſcharged through the excretory ducts of each gland for their determinate uſes. If now the diſcharge of the ſecerned juice is by any cauſe obſtructed, it will conſequently be accumulated and diſtend

the follicule or cell in which it was contained; and the moſt fluid parts of that ſecerned humour being either diſſipated or abſorbed, the remainder will be inſpiſſated and rendered impervious. Now the impetus of the circulating humours may very well act upon the veſſels which compoſe the membranes of the diſtended follicule, but not at all upon the matter contained in its cavity; whence it is evident, that the matter will remain there irreſolvable, frequently by any artifice. But the more fluid parts being diſſipated, even the thinneſt of our juices may by ſtagnation concrete in a ſurprizing matter, as we are well aſſured. The bile which ſtagnates in its veſicle, does often thus concrete into ſtones whenever its excretory duct is obſtructed. Even the urine which is more limpid, gives riſe to the ſtone by being too long retained: and it will be made to appear hereafter, in the hiſtory of calculi, that ſuch ſtony concretions are alſo formed ſometimes in the ventricles of the brain, in the cavity of the abdomen, &c. which parts are nevertheleſs furniſhed only (in their natural ſtate) with a very thin dew exhaling from the ſmalleſt arteries. The internal ſurface of the noſe in an healthy perſon being well cleanſed, diſcharges a very thin lymph; but after this humour has ſtagnated for ſome time, and exhaled its more ſubtle parts, it then acquires the toughneſs of a ſkin. Many more inſtances of the ſame nature might be alledged, but theſe are ſufficient to prove, that very thin humours in the body may give riſe to the worſt concretions.

SECT. CCCXCIII.

THE prognoſis of an inflammation is deduced from conſidering its cauſe, part affected, magnitude, depth, violence, the habit of the patient, the ſeveral ſymptoms; and by comparing theſe

theſe with the demonſtrative ſigns, and effects or conſequences of the inflammation.

We have now conſidered the various ſigns and events of a preſent inflammation, and it therefore remains for us in this place, to enquire into its prognoſis, which determines the good or bad event which we may reaſonably expect. But in order to know whether an inflammation inclines either to a ſalutary diſperſion, a mild ſuppuration, a gangrene, or a ſcirrhus, we ought to conſider the following particulars.

The cauſe.] Thus, for example, the contagion of the ſmall pox ſo alters the habit of the moſt healthy perſon, that in three days time the whole ſurface of the external ſkin, and often that of the œſophagus, ſtomach, *&c.* is beſet with inflammatory puſtules: but in this caſe a reſolution can never be expected, but a ſuppuration always, or in the worſt ſpecies a true gangrene follows. But from the contagion of the meaſles, the external ſkin is inflamed indeed, but a ſuppuration never follows, and the diſorder terminates in a ſcaling off of the cuticle. All authors who have attended people in the plague, have obſerved that inflammations ariſe in different parts of the body, which are ſometimes ſo ſevere, that the inflamed part is in a few hours time burnt up to a cruſt, which is afterwards ſeparated or caſt off from the other ſound parts by a ſuppuration of matter formed round its circumference. It is therefore apparent, that a very different event of an inflammation is to be expected, according to the variety of cauſes from whence it may ariſe.

Part affected.] Namely as it is more or leſs neceſſary towards life and health. Thus, for inſtance, in the hand, an inflammatory tumour, though violent, may be eaſily ſupported; but if a ſlight inflammation and tumour ſhould be ſeated in the membrane which inveſts the parts about the glottis, or its rima, the patient

tient will then be ſuffocated in a little time. If a phlegmon turns to a gangrene either in the hand or foot, the mortified part may then be ſeparated from that which is living; but if the like diſorder is ſeated in the brain, it is evident there can be little or no hope. But there is not only a more or leſs danger, according to the different nature of the affected part, but alſo the way of terminating an inflammation is alſo very different on the ſame account. In a glandular part there is danger of a ſcirrhus; but in thoſe parts of the body where there is much fat, an inflammation frequently terminates in abſceſſes and fiſtulæ very difficult to cure; as, for inſtance, about the anus, *&c.*

Magnitude.] For the larger the ſpace which the phlegmon occupies, the more numerous are the obſtructed veſſels, and the greater is the quantity of the impervious fluids in thoſe veſſels: and at the ſame time the velocity of the circulation through the other veſſels which remain pervious, is proportionably more violent, as was obſerved in the commentary on § 382. numb. 8. But all theſe circumſtances are repugnant to thoſe conditions neceſſary for reſolving an inflammation, (ſee § 386.) and therefore a ſuppuration or a gangrene is to be always expected in ſuch a caſe.

Depth.] It was demonſtrated in the commentary on § 374. that almoſt all parts of the body are capable of inflammation, which is in no part more frequently and obſtinately ſeated, than in the tunica adipoſa. Therefore a deep inflammation muſt be either ſeated in this membrane, or in other parts. If it is ſeated in the fat, which inſinuates itſelf very deeply betwixt the muſcles, then the efficacy of external remedies can ſcarcely penetrate ſo far; and if a ſuppuration or a gangrene follows from ſuch an inflammation, it will be very difficult to deterge or cleanſe the parts. But if the inflammation is ſeated in the tendons, muſcles, veſſels, membranes, perioſteum, or in the bones themſelves; it is then evident for the ſame

reaſons,

reaſons, that its cure muſt be difficult. But what bad conſequences may follow from an inflammation of the viſcera themſelves, we ſhall hereafter declare, when we come to treat of acute or inflammatory diſeaſes.

Velocity.] While the impervious humours ſtagnate in the impervious veſſels, the blood which is impelled into them by the remaining vis vitæ, produces certain effects, which are alſo at the ſame time the ſigns of inflammation, enumerated in § 382. But if theſe increaſe ſuddenly, if the redneſs, tumour, heat, pain, &c. increaſe in a moment, we may eaſily foreſee that the tender veſſels will be ruptured in a ſhort time, and that we are by no means to expect a reſolution, but a ſpeedy gangrene; (ſee § 386.) and therefore a ſedate motion of the humours is reckoned among thoſe conditions which are required to diſperſe an inflammation; and, on the contrary, a ſwift motion of them denotes a ſuppuration or a gangrene to be at hand.

Habit of the patient.] Every individual perſon has his particular healthy ſtate; and although the diſpoſition of the ſolids and fluids appear very different in two ſeveral people, yet we often ſee that both of them enjoy a perfect ſtate of health; but in ſuch a manner, that one of them is inclined to one ſort of diſeaſes, and the other is more inclined to another ſort of diſeaſes. The ruſtic who has been inured to hard labour can hardly eſcape from a pleuriſy, becauſe his blood is very compact or thick, and his veſſels being rigid, there is little or no hope of obtaining a mild reſolution; but in thoſe who are of a lax and weak habit, ſuch inflammatory diſeaſes are much more eaſily cured. But the morbid as well as the natural habit of the patient makes an inflammation terminate variouſly: thus the cold and phlegmatic are ſeldom troubled with inflammations, which are but ſlight, if they ever invade; but if a putrid ſcurvy ſhould have infected the humours, the leaſt inflammation, or the ſlighteſt

ſlighteſt wound often degenerates into the moſt ſtubborn ulcer, or a gangrene.

Symptoms, &c.] Of theſe we treated at § 382. et ſeq. From conſidering, all which, one may foreſee what event is to be expected from the inflammation, and thus the prognoſis is abſolved.

SECT. CCCXCIV.

IT is alſo apparent that the curative indications will be different according to the different ſtate of the diſorder.

We come now to deduce the curative indications from all that has been ſaid before, in order to direct us to the means proper to remove the known diſorder. But nothing is of more pernicious conſequence in medicine, than to preſcribe a general method of cure to a diſeaſe, without having a regard to the particular ſtate, and various circumſtances of it. Thus in fact we have different diſeaſes which come under the denomination of a pleuriſy; and which though they are alike in their beginning, yet do they often differ widely as they increaſe, and require a very different method of cure. And again the ſame pleuriſy requires to be treated in a different manner at its beginning from what it does when it has continued for ſome days, and afforded manifeſt ſigns of an incipient ſuppuration. There is therefore no general method of cure to be preſcribed to an inflammation, but it requires a different treatment, according as it inclines to terminate in this or that manner. It is indeed true, that an inflammation ought always to be removed if poſſible by a reſolution, when that ſeems practicable; but if, for example, there are ſigns of a gangrene, the only method that remains is to ſeparate the dead from the living parts, by procuring a ſuppuration, to promote which, all the curative

rative intentions are to be directed entirely to that end: and ſo long as there are any hopes of a reſolution, all the endeavours of art are to be uſed to prevent a ſuppuration, eſpecially when the inflammation is ſeated in ſome internal part of the body. It will therefore be proper to conſider theſe four methods of terminating an inflammation ſeparately, and to deſcribe the treatment proper to each. In the firſt place, therefore, we ſhall treat of the cure of an inflammation by a reſolution; that is, by reducing the concreted and ſtagnant matter of the inflammation to a ſtate of fluidity and motion.

SECT. CCCXCV.

FOR if any of the cauſes (375, to 379.) have produced an inflammation (371) in any part (372, 373, 374, 379,) which is attended with the ſymptoms (383, 384,) and primary conditions (386) then the following indications ariſe.

1. To prevent further injury from being offered to the veſſels.
2. To remove that injury which they have already ſuffered.
3. To render and preſerve the obſtructing matter fluid and mild.
4. Or, if that cannot be performed, to repel the matter back into the larger veſſels.

As this diſtinction will be ſo highly uſeful in the cure of a pleuriſy, peripneumony, quinſy, and the like diſeaſes, therefore each of theſe particulars are to be well conſidered.

The condition of the diſeaſe whoſe cure we ſhall preſently deſcribe, is very exactly determined in this text. For from whatever cauſe the inflammation ariſes,

ariſes, or whatever part of the body it occupies, whether external or internal, a reſolution of it may be always attempted, provided it is recent, and attended with thoſe circumſtances which are enumerated in § 336. And thus may the inflammation be terminated, when there is a poſſibility of performing what is mentioned in the four following numbers.

1. To reſolve an inflammation, it is required to reduce the concreted or obſtructing matter to a ſtate of fluidity, and reconcile the ſtagnating humours to their proper motion; as we obſerved before at § 386. But if the continuity of the veſſels is not preſerved, the humours extravaſated from the broken veſſels will neceſſarily ſtagnate and corrupt: but in every inflammation there is a tumour from the diſtention of the veſſels, and a pain from the diſtraction of their fibres, approaching near to a rupture, both which denote that if the ſame cauſes continue to act, the veſſels will then burſt; but when the continuity of the veſſels is diſſolved, a ſuppuration follows, or elſe a gangrene, if that ſolution of their continuity happens very ſuddenly. It is therefore evident, that in order to reſolve an inflammation, it is neceſſary to prevent any further injury of the veſſels.

2. So long as the inflamed veſſels remain entire, their injury conſiſts in too great a dilatation, and a diſtraction of their ſides, by the impulſe of the vital humours againſt the obſtructions: if therefore this too great diſtention of the veſſels is removed, this indication will then be ſatisfied.

But the two preceding curative indications relate to the ſolids, and thoſe which follow reſpect the fluids.

3. The concreted or impervious fluid ſtagnates in the obſtructed veſſels; and as an inflammation can take place only in the arteries, (ſee § 371.) the impulſe of the humours urging behind, will always drive the obſtructing matter further into the narrow parts of the veſſels; it is therefore required ſo to attenuate this matter, as that it may be capable of paſſing through

through the ſmalleſt extremities of the obſtructed veſſels. But a bare attenuation of the concreted fluid will not ſuffice, unleſs the mild or unacrid ſtate of the humours is alſo preſerved; for concreted blood may indeed be reſolved by a putrefaction, but then it alſo acquires a great acrimony. But an acrimony mixt with the blood which is in this caſe rapidly moved through the tender veſſels, already weakened by too great a diſtention, would deſtroy them in a very little time; whence a gangrene would then follow inſtead of a mild reſolution: for it was demonſtrated in the commentary on § 388. that an acrimony of the humours cauſes an inflammation to tend ſpeedily to a gangrene. It is therefore hence apparent, that the mild ſtate of the humours muſt be preſerved, beſides reducing them to a ſtate of fluidity.

4. Sometimes the orifices of the veſſels are ſo dilated as to admit ſuch groſs particles, that we can ſcarce hope to attenuate them, ſo far as to procure a free paſſage of them through the ſmalleſt extremities of the obſtructed veſſels. Thus the red blood enters the pellucid veſſels, even of the cornea itſelf in the worſt ſpecies of an ophthalmia, whoſe veſſels are much more minute than thoſe of the adnata tunica; but thoſe veſſels in their natural ſtate, will exclude all ſuch parts of the blood as have any colour. So that although the red impervious blood which ſtagnates in theſe veſſels, ſhould be reſolved into ſerum, and that ſerum again into lymph, which is a degree thinner, yet its particles would not be capable of pervading the ſmalleſt extremities of thoſe very minute vaſcules. There is therefore but one means left in this caſe to reſolve the inflammation; namely, to repel the obſtructing particles, from the narrow ends of the veſſels into which they are impacted, towards their larger baſes, and from thence into the larger veſſels; ſo that being returned into the circulation, the obſtructing matter may be reſolved by the motion and attrition

trition of the veſſels, and of the other contiguous particles.

SECT. CCCXCVI.

ANY further damage to the veſſels is prevented:

1. By removing or correcting the known cauſes (375 to 380.)

All that art can do in the cure of diſeaſes, is to reſtore the parts to their healthy ſtate; but the cauſes, which are enumerated in the aphoriſms here cited, are ſuch as may cauſe an inflammation even in the moſt healthy perſon; and therefore all endeavours will prove fruitleſs, unleſs theſe cauſes can be removed: as for inſtance, when an inflammation ariſes about the os ſacrum and coccyx, from a perſon's lying too long on his back, it will not be poſſible to prevent that inflammation from turning to a gangrene, unleſs the preſſure of the incumbent weight of the body can be taken off; and the ſame is alſo apparently true with reſpect to the other cauſes of inflammation.

2. By diminiſhing the force of the arterial blood by bleeding and purging.

There are two things which concur in the definition of an inflammation, as explained at § 371. namely a ſtagnation of the arterial blood in the ſmalleſt veſſels, joined with a preſſure and attrition from the reſt of the blood, which is more ſtrongly urged into the obſtructed part by a fever. Now the impervious blood ſtagnating in thoſe veſſels indeed cauſes an obſtruction, but there is from thence no further injury offered to the obſtructed veſſels if they are not urged or diſtended by the impetus of the blood acting

ing behind. Therefore the chief thing required to prevent the inflamed veſſels from ſuffering any further injury, will be ſo to diminiſh this impetus, as that the veſſels can be neither ruptured nor more diſtended by the arterial blood; whoſe motion cannot be totally removed, and at the ſame time continue life in the part; but yet it may be rendered ſo gentle as to do no further damage. But this is obtained by

Bleeding.] It was ſaid at § 381, that the remaining life produces certain effects in the obſtructed parts, which were at the ſame time the ſigns of an inflammation: but the malignity of an inflammation is to be meaſured by the number and magnitude of theſe effects, which alſo indicate in what manner the inflammation will terminate. When therefore the vis vitæ is diminiſhed, or rendered leſs active by any cauſe, thoſe effects, which reſult from the impulſe of the vital humours into the obſtructed veſſels, will be diminiſhed. Now we are capable of diminiſhing the impetus of the blood to any degree which we pleaſe, even until death or a perfect reſt barely by bleeding; and therefore we may reſtrain the force of the circulation more or leſs, according to the degree of this evacuation. Helmont[a] and many others after him have baniſhed this waſting of the blood as uſeleſs and pernicious in the cure of inflammatory diſeaſes: for they believed, for inſtance, that a pleuriſy aroſe from an hoſtile acid, fixing itſelf like thorns into the intercoſtal membranes and veſſels: and therefore, cried they, bleeding is to no purpoſe, but we muſt remove the pleuritic ſpiculæ; the bloody Moloch prevailed over the medicinal profeſſors, who then taught that this diſeaſe was to be conquered by ſpecific remedies, and not by weakening the ſtrength with bleeding, &c.[b]. But it is evident from what has been ſaid before, that theſe pleuritic ſpiculæ are nothing more than the impervious blood heſitating in the ſmall ar-

[a] Helmont. in capit. Pleura furens, pag. 319. n°. 13.
[b] Ibid. pag. 322.

teries, and that the humours, urging on the back of theſe obſtructions, drive in their ſpiculæ, that is, produce a pain from the diſtraction of the fibres. It is indeed true, that a perfect cure might be obtained, if the impervious blood, which there heſitates, can be inſtantly diſſolved, and reduced to a ſtate of fluidity: but whether or no Helmont could effect this by his boaſted ſpecifics, ſuch as goat's blood dried and reduced to a powder, eſpecially that which was diſcharged from cutting off the teſticles; the ſtag's pizzle, wild poppy flowers, &c. will appear very doubtful to one who reads how little ſerviceable they proved to himſelf in the like diſeaſe, as he relates towards the end of the ſame chapter. As therefore there has not been any remedy as yet found, which deſerves to be truſted as a ſpecific for reſolving immediately the ſtagnant and impervious blood in this diſeaſe, whether externally or internally applied; therefore nothing more uſeful can be done, than to prevent the further ingreſs or protruſion of the obſtructed matter into the more narrow parts of the converging veſſels, and at the ſame time to prevent it from growing more compact and firm: but both theſe intentions may be obtained by diminiſhing the force of the arterial blood, which may be moſt commodiouſly and ſafely performed by phlebotomy, as alſo by

Purging.] For next to bleeding this evacuation moſt effectually diminiſhes the force of the blood. In the *materia medica* correſponding to this aphoriſm, you have a liſt of thoſe purgatives which act without much increaſing the motion of the blood, and which even attenuate or diſſolve our humours at the ſame time. This method is even recommended by Sydenham, who diligently inculcates the ſame in his *Schedula Monitoria*, concerning the coming in of a new fever at that time, which treatiſe he wrote towards the end of his life, after he had ſpent thirty years in the practice of phyſic, and in diligently obſerving the courſe of nature in diſeaſes. He there treats of an inflammatory

inflammatory fever, with a ſudden determination of the morbific matter towards the brain: and after premiſing phlebotomy, he preſcribes a purging draught *ex tamarindis, rheo, ſenæ foliis, manna, &c.* and in the evening he gave a gentle paregoric to quiet the diſturbance from the purge, though but ſlight. He repeated ſuch a purge every other day to the third time, and by that means happily cured the diſeaſe, which was of its own nature dangerous enough; but he diligently obſerves, that theſe purgatives were prejudicial, unleſs phlebotomy had been premiſed.

But it is very evident, that all theſe aſſiſtances of art are not required in every inflammation, but only in thoſe caſes, where the continuity of the affected part, being abſolutely neceſſary to life and health, will not admit of any other way of terminating the inflammation; or unleſs the inflammation is ſeated in ſuch a part of the body, as will not admit of diſcharging the matter after a ſuppuration is made, from whence the moſt fatal conſequences might be expected.

3. By diminiſhing the quantity of the humours by the ſame means.

It was ſaid in the commentary on § 378, that one of the moſt frequent cauſes of inflammation was too great a dilatation of the lymphatic arteries, by which they admit groſſer parts of the blood than are able to paſs through their ſmall extremities. Alſo in the commentaries on § 106. numb. 4. and § 118. it was demonſtrated, that a plethora is one of thoſe cauſes, by which the orifices of the veſſels are dilated: ſince therefore bleeding and purging diminiſh the quantity of the humours, they will ſerve to remove thoſe cauſes of inflammation. Beſides this, the quantity of fluids being diminiſhed, there will be a leſs compreſſure and coheſion of the particles of the blood to each other; from which compreſſure the inflammato-

ry ſpiſſitude of the blood very frequently ariſes. For if the blood impelled from the heart was to run into the arteries in an empty ſtate, it would there meet with no reſiſtance, and conſequently could ſuffer no compreſſure: but when the heart forces out its blood into full arteries, thoſe arteries muſt either be dilated, or the blood contained in their cavities muſt be compreſſed, but the arteries reſiſt dilatation the more as they are fuller, and therefore in that caſe the blood will be condenſed or thickened. Therefore for this reaſon an inflammation is juſtly reckoned among the effects of a plethora § 106. numb. 4. and therefore by diminiſhing the quantity of the fluids moving in the veſſels, the body is rendered very much averſe to inflammation; and it rather inclines to an oppoſite diſorder, namely a dropſy, which uſually follows profuſe evacuations.

4. By making a revulſion of the blood's force into other parts by ſuction, friction, ſynapiſms, bliſters, fomentations, warm bathing, iſſues, ſetons, and ſtrong purging of the bowels.

Theſe artifices were conſtantly uſed by the wiſe antients, as appears from the monuments which they have left us. Hippocrates [c], in treating on a quinſy, ſays, *Sic affectis à venis, quæ in brachiis ſunt, ſanguis detrahendus eſt; ſimulque alvus ſubducenda; ut, quod morbum exhibet, id avellatur, etc.* "In thoſe who are "thus affected, blood is to be drawn from the veins "of the arms, and at the ſame time the bowels are "to be looſened or cleanſed, in order to draw off "the matter which cauſes the diſeaſe," *etc.* And thus Galen [d] recommends a revulſion, where he treats of curing the head-ach; *Revulſionem in totum corpus acribus clyſmatibus, et vinculis, ac multis infernarum*

[c] De locis in homine, cap. 11. Charter. Tom. VII. pag. 370.
[d] Galen. de Meth. Med. ad Glaucon. Lib. I. cap. 16. Charter. Tom. X. pag. 364.

partium

partium frictionibus; ſanguinis etiam nonnihil, ſi ita neceſſitas urgeat, detrahendo. Parti autem medemur, interim dum in totum corpus revellimus, ea capiti inſpergentes, quæ repellendi vim obtinent, &c. "A revulſion is "to be made in the whole body by ſharp clyſters, li- "gatures, and repeated frictions upon the lower "parts; and alſo by taking away ſome blood, when "that ſhall be found neceſſary. But in the mean time "we make a partial relief, while we procure the "general revulſion by the aſperſion of thoſe things "upon the head, which have a repelling force." There are many more paſſages of the like nature which occur in the ſame authors, from whence it appears, that they had much confidence in revulſions towards the cure of many diſeaſes. Helmont, who oppoſes the antients almoſt in every thing, laughs at theſe trifles of revulſions; and even ſince the time of Harvey many have refuſed their aſſiſtance, as being either uſeleſs or repugnant to the known circulation of the blood. But the uſe of revulſions in diſeaſes is confirmed by daily experience as well as by reaſon; for ſo ſoon as the reſiſtance to the blood's motion is either diminiſhed or totally removed in any part of the body, it immediately flows or is derived into that part with a greater velocity. Thus if an artery even but of a moderate ſize be divided, all the blood will flow through that veſſel which does not reſiſt. When all the veſſels and viſcera of the abdomen are ſuddenly freed from a conſiderable preſſure by the birth of an infant, all the blood is frequently derived into thoſe veſſels ſo forcibly, that unleſs the flaccid veſſels and viſcera are compreſſed by ſwathing with a roller, the child-bed woman may ſuddenly periſh in a fatal ſwoon for want of the blood's due preſſure in the veſſels of the brain and cerebellum. The ſame thing alſo happens if the abdomen is not ſwathed, when all the water is diſcharged at once by paracenteſis in a dropſy. It is therefore evident, that by diminiſhing the reſiſtance in any part of the body, the

blood will be derived thither more forcibly and plentifully. But the fulneſs of the veſſels, and the ſtrength of their coats, reſiſt the impulſe of the blood from the heart, which are impediments to their dilatation; and therefore every thing which leſſens the fulneſs of the veſſels, or occaſions their ſides to yield more eaſily to the diſtending blood, will derive the humours more powerfully and copiouſly into that part. If again we conſider, that the blood propelled by the heart is ſent partly upwards to the head, and ſuperior parts of the trunk, and partly downward to the lower extremities and viſcera; it will be from hence evident, that by diminiſhing the reſiſtance of the lower veſſels, or by evacuating them, the quantity and impulſe of the blood will then be derived more towards the inferior parts, and drawn from thoſe which are ſuperior. It is therefore poſſible to make a revulſion of the arterial blood from an inflamed part to any other; eſpecially when the part, towards which the revulſion is made, receives its blood from the ſame common trunks or larger arteries. Thus phyſicians foment the external parts of the head in inflammatory diſorders of the encephalon, that the impulſe of the blood being increaſed in the branches of the external carotide, it may urge with a leſs force upon the parts contained in the head. When the callus of a fractured bone is too luxuriant, (ſee the commentary on § 357.) Celſus tells us, *Quod conferat aliquid de ſinapi cum ficu in alterum pariter membrum impoſitum, donec id paululum erodat, eoque vocet materiam*; "That it will be of ſome ſervice to apply a fig and "muſtard to the oppoſite limb, till it has corroded "the ſame in a ſmall degree, and drawn thither the "matter." But all revulſives either relax the veſſels, or empty them by friction or a more frequent contraction excited in the veſſels by the application of things which ſtimulate upon the part, towards which the revulſion is to be made. But a revulſion is procured chiefly by the following means:

By

By ſuction.] Which is beſt of all made with cupping-glaſſes, by the uſe of which the preſſure of the atmoſphere is removed from the part of the ſkin to which they are applied, or at leaſt its preſſure is by that means conſiderably diminiſhed, whether the air be drawn out by ſucking or by the air-pump, or by much rarefying and expelling a great part of the air contained in the cupping-glaſs by burning flax. So ſoon as the equable preſſure of the air is taken off from the ſurface of the ſkin under the glaſs, all the veſſels are more diſtended, the part ſwells and looks red, and if the glaſſes are continued to be applied for a conſiderable time, a true inflammation may follow, or even a gangrene. Galen [e] has long ago obſerved, that pains are eaſed almoſt as with a charm, by making a revulſion with cupping-glaſſes. Hippocrates [f] has ordered the application of a very large cupping-glaſs to the breaſt to leſſen the menſtrual flux. And I have ſeen violent inflammations of the eyes cured barely by the application of cupping-glaſſes, when ſcarce any other remedies would take any effect. And of what conſiderable uſe cupping was in the like diſeaſes among the Egyptians, may be ſeen in Proſper Alpinus [g].

By friction.] By friction the veins, which yield more eaſily to preſſure, are therefore more eſpecially emptied; whence the arteries, which correſpond to thoſe veins, will more eaſily diſcharge their blood into the emptied veins; therefore the reſiſtance of the blood flowing into thoſe arteries will be diminiſhed: whence it will be derived thither with a greater impetus and in a greater quantity, as is evident from what has been ſaid before. For this reaſon any part of the body may by friction only grow hot, red, and become inflamed: and if the friction is continued, the increaſe of the blood's heat and motion will be com-

[e] Meth. Med. Lib. XII. cap. ult. Charter. Tom. X. pag. 292.
[f] Sect. V. Aphor. 50. Charter. Tom. IX. pag. 224.
[g] De Medicina Ægypt. Lib. II. cap. 14.

municated throughout the whole body: and for this reaſon Celſus [h] condemns friction long continued in acute diſeaſes; when he ſays, *Longa vero frictione uti, neque in acutis morbis, neque increſcentibus convenit; præterquam cum phreneticis ſomnus ea quæritur*; "But "the uſe of long continued frictions is neither pro- "per in acute diſeaſes, nor in thoſe which are in- "creaſing, becauſe it induces both a phrenzy and a "ſleepineſs." And a little after, ſpeaking of the uſe of friction, he ſays, *Nam et capitis longos dolores ipſius frictio levat; non in impetu tamen doloris: et membrum aliquod reſolutum ipſius frictione confirmatur. Longe tamen ſæpius aliud perfricandum eſt, cum aliud dolet: maximeque cum à ſummis, aut à mediis partibus corporis materiam evocare volumus: ideoque extremas partes perfricamus*; "For friction alſo eaſes inveterate "head-achs, but it is not to be applied when the "pain is moſt ſevere: and a paralytic or weak limb "becomes ſtronger by a friction of it. But when "one part aches, it is much more uſual to make the "friction upon another part more remote, and eſpe- "cially when we intend to call off the morbific mat- "ter from the upper or from the middle parts of the "body; for in that caſe we make frictions upon the "extremities."

Synapiſms or epiſpaſtics.] Thus are called thoſe remedies, from their drawing power, becauſe they derive the humours in a greater quantity, and with more force into the parts to which they are applied. Now although every thing, which relaxes and weakens the veſſels in any part of the body, may be termed attractives, becauſe a relaxation of the veſſels gives a more eaſy entrance to the humours; yet by this name we generally underſtand thoſe topical remedies, which irritate the veſſels of the part to which they are applied by an acrid ſtimulus, ſo as to make them contract more frequently and more powerfully, that is, they accelerate the motion of the vital humours

[h] Lib. II. cap. 14. pag. 89.

through

through their veſſels. Theſe attractive remedies have received various denominations, according as they poſſeſs a greater or leſs acrimony. Thoſe which only excite a redneſs in the part to which they are applied, are termed phænigmi; but if they excite a great redneſs with heat, itching, and a tumour in the part, they are uſually called ſynapiſms, becauſe ground muſtard-ſeed, being applied to any part of the body, produces all thoſe appearances: if they are yet more acrimonious, and raiſe the cuticle into bliſters, they are then called veſicatories; or if again they produce the effects of fire upon the part by their ſtrength, they are termed cauſticks. All theſe excite a true inflammation in the part to which they are applied, and if they are very ſtrong, they may increaſe that inflammation even into a gangrene. But what efficacy all theſe have to derive the impetus of the blood towards other parts, is taught by daily obſervation and practice. If the feet of a perſon, who is ill with an acute phrenzy, be involved in a paſte made with ground muſtard-ſeed, ſcrapings of horſe-radiſh, or the like, the diſorder will frequently be relieved in a few hours, and the patient will begin to come to his ſenſes by the pain and inflammation thus produced. When nature endeavours to ſeparate any offenſive matter from the whole maſs of blood, and to depoſit it upon ſome particular part of the body, phyſicians then uſually determine the wandering matter towards a part, where it will be the leaſt offenſive, by applying epiſpaſtics; and this they do often with very good ſucceſs. Thus in the ſmall-pox, when the legs and feet have been fomented with emollient decoctions in the beginning of the diſeaſe, and theſe epiſpaſtics afterwards applied to the ſoles of the feet, I have frequently ſeen, that the puſtules have gathered extremely thick in the lower parts of the body, when at the ſame time there were but very few eruptions in the face and upper limbs.

Veſicatories.]

Veſicatories.] Theſe, as we ſaid before, are yet ſtronger than epiſpaſtics, and ſeparate the cuticle from the ſkin of the part to which they are applied, raiſing it into bliſters, diſtended with a thin liquor, whence they derive their name. Every thing, which can excite the moſt violent inflammation, are alſo veſicatories; for when an inflammation turns to a gangrene, theſe little bliſters of the cuticle afford almoſt the firſt ſign of the incipient gangrene: and in the ſame manner actual fire raiſes the cuticle into bliſters. Hence the moſt acrimonious remedies, ſuch as the ranunculi pratenſes, hydropiper, ſedum minus acre, *etc.* being either applied in too great a quantity, or continued too long upon the part, they raiſe bliſters in the ſkin. But of all this tribe of remedies, cantharides are the moſt frequently in uſe; which dry and juiceleſs inſect I have known to retain its force of bliſtering, though kept in a glaſs negligently ſtopt for the ſpace of above thirty years. Cantharides, being groſsly pulverized, and mixed with ſome ſticking plaiſter, or with ſome dough of which they make bread, and applied to the part towards which the revulſion is to be made, are ſuffered to continue there for the ſpace of eight or ten hours, within which time they uſually elevate the cuticle into a bliſter. But if the cantharides are left too long upon the part, they often excite intolerable pains by irritating that nervous pulp, which lies immediately under the cuticle; and ſometimes they even excite a ſevere ſtrangury and bloody urine.

But as all theſe things have a powerful acrimony, and frequently increaſe the velocity of the blood throughout the whole body, by irritating the part to which they are applied, (which yet is a circumſtance repugnant to the indication in this caſe, as is evident from numb. 2. in this aphoriſm,) therefore great caution is always neceſſary in the uſe of them.

Fomentations and warm bathing.] Theſe are uſually compoſed of water, with the addition of ſuch things

things as are emollient or relaxing. But all of them act by relaxing the ſolids, ſo as to diminiſh the reſiſtance of the veſſels, whereby they will be more eaſily dilated, even though the diſtending cauſe remains the ſame. The moſt efficacious of all theſe are baths of warm vapours; for a part of the body, being expoſed for a quarter of an hour to the vapours of warm water only, begins to ſwell. But when a revulſion is to be made towards ſuch a part of the body, which cannot be conveniently immerged in the bath, fomentations may then ſuffice, provided they are retained warm.

Iſſues.] The ſkin is here divided with a lancet down to the panniculus adipoſus, or elſe corroded by the potential cautery in thoſe who are afraid of the knife. The wound thus made is filled with a little ball of gold, ſilver, ivory, or any other matter which is not eaſily changed, and then covered with a ſticking plaiſter to prevent the globule from ſlipping out of the wound. Thus a foreign body, being interpoſed betwixt the lips of the wound, prevents their concretion, and at the ſame time a ſlight contuſion and irritation is made throughout the whole compaſs of the wound by the hard body, which makes a daily ſlight inflammation in the part, towards which the impulſe of the arterial blood muſt be therefore derived. Theſe iſſues are chiefly ſerviceable ro thoſe patients who have their ſolids ſo weak or flexible, that the leaſt exceſs of the blood's impetus dilates their veſſels, which permit the groſſer parts of the blood to miſtake their courſe. Thus, for inſtance, thoſe who have an inflammation of their eyes upon every ſlight occaſion are very frequently relieved by iſſues. But when a violent inflammation ſuddenly invades any part, it is evident enough that iſſues will be uſeleſs; for the part affected may be long corrupted by a gangrene before iſſues can be ſuppoſed to produce any effect. The ſame is alſo true of

Setons.]

Setons.] Theſe are generally placed in the nape of the neck, where the ſkin and panniculus adipoſus being taken up with a pair of plyers for the purpoſe, the ſurgeon then perforates them with a large needle, armed with a large thread which he leaves in the wound, and which being daily drawn through the wound, irritates and excites a continual inflammation in the part where the ſeton is fixed. Theſe are of the ſame uſe with iſſues, but they generally have a more conſiderable effect, as they produce a greater pain and irritation. I have ſeen the moſt obſtinate head-achs cured by the revulſion which a ſeton makes, when they have proved inflexible to all other remedies; and there are many inſtances which occur in the beſt authors confirming the ſame thing. We have a remarkable caſe of this nature related by Ruyſch [h], of a girl eighteen years old, of a ſanguine habit, who was continually tormented with an intolerable head-ach. The moſt efficacious remedies uſual in theſe caſes were tried without ſucceſs, ſuch as purging, repeated phlebotomy, bliſters, ſternutatories, cupping-glaſſes. Even a large wound had been made in the integuments of the head by a crucial inciſion, which was attended with a conſiderable hæmorrhage, but without ſucceſs, inſomuch that ſome eminent ſurgeons had thoughts of trepanning the cranium. But before they proceeded to this laſt and ſevere remedy, Ruyſch propoſed the application of a ſeton, which being made, the pain preſently vaniſhed: and the patient being tired with its troubleſomeneſs, took out the thread, whereupon the pain which had been hitherto dormant, again revived; but a new ſeton being made, it preſently diſappeared; but even a third time the ſeton being healed up, the moſt troubleſome head-ach returned, which again yielded to a new ſeton.

Strong purging.] How ſerviceable it is in inflammatory diſeaſes to diminiſh the quantity and impulſe

[h] Obſervat. Chirurg. n. XL. pag. 39.

of

of the humours by purging, and what purges are proper for that purpoſe has been already declared at numb. 2. of this aphoriſm. But it is to obſerved, that the ſame evacuation may be likewiſe uſeful as a revulſion, to drive the impetus of the blood from an inflamed part, eſpecially when the diſorder is ſeated in the upper part of the body. For ſo powerful a derivation may be made through the meſenteric veſſels towards the cavity of the inteſtines, that there hardly remains any preſſure of blood in the veſſels towards the encephalon; inſomuch that the ſtronger purges frequently occaſion a vertigo, and even fainting by this ſame means. When the whole tunica adnata looks red in an ophthalmia, by the entrance of the red blood into the ſmaller veſſels; in that caſe, by giving a ſtrong purge, the blood is repelled back into the larger veſſels, while a paleneſs invades the face and eyes, whence a ſpeedy and happy cure is frequently made. Clyſters frequently thrown into the bowels do often produce the ſame effect, partly by relaxing the veſſels, and partly by driving the impetus of the humours that way, by a gentle ſtimulus. Hippocrates [1] treating on the cure of a pain in the ear, after having ordered the application of cupping-glaſſes on the oppoſite part, to turn off the afflux, he ſays: *Si hæc nihil juvent, medicamentum propinandum ſit, quod deorſum purget; ſurſum vero minime, cum vomitus nihil conferat, etc.* "If theſe avail no-"thing, a medicine is to be given which will purge "downward, but by no means upward, ſince vomiting "is of no ſervice," *etc.* And a little after, treating of an ophthalmia, he adds: *Si ſubitiſſime (oculi) inflammationem conceperint, nihil omnino illine; ſed vel fortiſſime in inferioribus partibus inurito; vel alio quopiam alvum ducente medicamento extenuato; cavendo ne vomitum facias*; "If the eyes are ſuddenly taken with "an inflammation, do not anoint them with any "thing at all, but make a powerful cauterization in

[1] De locis in homine, cap. 6. Charter. Tom. VII. pag. 364.

"the

" the lower parts, or reduce the habit by giving ſome " other medicine which purges the bowels, taking " care not to make the patient vomit." From whence it is evident, that the ancient phyſicians uſed purges to make a revulſion from inflamed parts, and that the purges were of that nature as to act ſtrongly; ſince Hippocrates in this place uſes the term which denotes an extenuation or waſting of the body, and a collapſion of the veſſels, by a powerful evacuation. But he orders vomiting to be induſtriouſly avoided in theſe caſes, becauſe in the act of vomiting the blood is derived more plentifully and violently towards the head; as is apparent, if a perſon looks at a man while he is vomiting; for the eyes look red and watery, the lips and whole face are diſtended and ſwelled with blood, *etc.*

5. By a dry and cool air, the affections of the mind, being either ſilent or very ſedate; by procuring a natural or artificial reſt to the patient; by uſing a thin, fluid, and cooling diet, with a drink of the like nature, and uſing diluent and cooling medicines at the ſame time.

This number treats of thoſe means by which the motion of the humours through their veſſels may be rendered the more ſedate, in order to hinder any further injury from being offered to the veſſels which are inflamed.

A cool and dry air.] That is cool ſo far as it is received into the lungs in reſpiration. For the blood propelled from the right ventricle of the heart, receives a great heat and attrition from the ſwiftneſs of its motion through the pulmonary artery, and therefore requires to be cooled by the air, as is evident from phyſiology. But if the external air is too hot, it cannot be then expected to cool the blood. Now it appears from experiments made on living animals,

animals, that a moſt acute fever may ariſe, barely for want of this cooling of the blood by the air, which proves fatal in a few minutes time, if the air in which thoſe animals are included is very hot [k]. It is therefore evident, that a cool air conduces much to moderate the ſwiftneſs of the circulation of the blood. But a dry air is to be preferred (*cæteris paribus*) before a moiſt air, which laſt, if cold, may cool the blood too much. For we conſtantly obſerve, that people are ſenſible of a greater cold in autumn or winter, when the air is moiſt, than when it is dry, notwithſtanding the thermometer denotes the ſame degree of heat; which ſeems to follow, becauſe the air which has little or no moiſture, is ſooner heated by the warmth of our bodies: for, in general, it is to be obſerved, that bodies grow hot ſooner or later by the ſame degree of fire, in proportion as they are more or leſs denſe, whether they be ſolids or fluids [l].

The affections of the mind either ſilent or ſedate.] That the circulating motion of the blood may be very much accelerated by violent paſſions in the mind, is evident from daily and certain experience. But of this ſubject we treated in § 99. numb. 1. Whence it is evident, that theſe paſſions ought to be induſtriouſly avoided; or if they ſhould ariſe, they are to be immediately quieted; the manner of effecting which has been ſaid in the commentary on § 104.

By procuring natural or artificial reſt.] How ſerviceable reſt is in all diſeaſes, in which there is too great a velocity in the blood's motion, has been ſaid in the commentary on § 105. But when the mind is not diſcompoſed by any paſſions, and nothing operates ſtrongly upon any of the ſenſitive organs, a quiet ſleep then uſually creeps on of its own accord; for which end the antient phyſicians cauſed their patients to lie in a dark place free from the leaſt noiſe, in all acute or inflam-

[k] H. Boerhaave Chem. Tom. I. pag. 275, &c. [l] Ibid. pag. 279.

matory

matory diſeaſes. But if this reſt cannot be thus procured, after premiſing thoſe means mentioned in the preceding numbers, we may then ſafely apply to the uſe of anodynes. See more on theſe remedies in the commentaries on § 202, and 229. numb. 2.

A thin, fluid, and cooling diet.] In order to reſtore thoſe parts which are continually waſted from the body, by the unavoidable actions of life and health, it is required of us to be continually taking in aliments at proper intervals; and though theſe aliments are of the beſt nature which we can chooſe, yet they have always ſomething of a foreign diſpoſition, and therefore require to be altered into our own nature by the action of the veſſels and viſcera. But while this attenuation and change is made in our ingeſted aliments, if they are taken either in too large a quantity, or are not eaſily ſuſceptible of that change, they excite a fever even in the moſt healthy people; by which means the inflexible matter which produced the fever, is either attenuated or diſcharged. Even every day the moſt healthy perſon may perceive an increaſe in the quickneſs of the pulſe, ſome hours after dinner. But as thoſe powers which are to change the crude aliments into good blood are weaker, ſo much more is the blood's motion accelerated by the ingeſted aliments. Thus if a weak girl ſhould have dined upon fleſh which has been dried in the ſmoak, upon fat bacon, or food of the like hard digeſtion, ſhe will certainly be feveriſh within a few hours afterwards: and phthiſical people who are gradually waſted by an hectic fever, even theſe perceive an increaſe of their fever, by taking more milk than uſual. But as the aſſimilation of the ingeſted aliments into healthy animal juices, depends chiefly upon the action of the ſolids upon the fluids, and upon a conſiderable quantity of healthy ready formed juices, which are to be gradually mixed by a little at a time with the crude chyle; (ſee the commentary on § 25.) and as by bleeding and purging (prefcribed at numb. 2, and 3.

of

of this aphoriſm for reſolving an inflammation) the ready formed or concocted humours are evacuated, and the force of the circulation diminiſhed; it is therefore evident, that the diet ought to conſiſt of ſuch things only, as are very eaſily attenuated and digeſted. Every thing therefore which can be eaſily changed into good chyle, even by a ſlight action of the chylificative viſcera, and may be afterwards eaſily attenuated further, ſo as to form good blood, by the action of the lungs and arteries, will be here convenient: as the whey of milk, eſpecially that ſouriſh kind which is made from butter-milk: milk diluted with two or three times as much water, barley, or oat-gruel, *&c.* with the juices lately expreſſed from garden-fruits; theſe are in this caſe very uſeful, eſpecially if taken in ſmall quantities at a time, and frequently repeated: for by ſuch a diet the body will never be oppreſſed, but will from thence be moderately cooled, which is extremely uſeful in acute inflammatory diſeaſes. People have even a ſpontaneous or natural appetite to ſuch cooling and thin aliments, when they are fatigued either with inflammatory diſeaſes, or by the intenſe ſummer's heat, and they have an averſion to food of a contrary nature: but, on the other hand, a cooling diet would be directly repugnant in the winter time for chronical and languid diſeaſes. And this doctrine we have expreſſed by Hippocrates, after his uſual manner, in a very few words, when he ſays: *Imbecilles diætæ frigidæ, valentes vero călidæ*; "That the weak are to "have cooling diet, but thoſe who are ſtrong and "well, a diet that is heating[m].

Drink of the like nature.] The juice of citrons, oranges, cherries, currance, their ſyrups or inſpiſſated juices, which are prepared by the confectioners, diluted with a large quantity of water, form a very pleaſant drink; out of which you may make an agreeable variety, changing the ingredients, from whence thoſe may be ſelected which are moſt pleaſing to the pa-

[m] Epidem. Lib. VI. textu 18. Charter. Tom. IX. pag. 494.

tient, ſince almoſt any thin liquor will ſuffiice for this purpoſe.

Uſing medicines which dilute and cool at the ſame time.] We have already ſeen, that the impervious blood ſtagnating in the ſmaller veſſels, ſuffers a compreſſion and attrition from the impulſe of the humours urging behind, as is evident from the definition of an inflammation given in § 371; and we demonſtrated in § 382. numb. 6. that this attrition is followed with an intenſe heat, therefore, to prevent any farther injury to the inflamed veſſels, it will be convenient to uſe ſuch remedies as may diſſolve the obſtructing or concreted matter by diluting, and at the ſame time remove the too great heat which ariſes. But, properly ſpeaking, we have in this caſe but one diluent, namely water; ſince all other medicines are no farther diluents than as they contain water. But we ſaid a little before, that thin and fluid aliments, or rather drinks, are here convenient; that is, as they contain more water, by which they conduce to dilution together with the medicines. But cooling medicines are ſuch as diminiſh or remove the cauſes of too great heat; which too great heat accompanying an inflammation, was demonſtrated (in § 382. numb. 6 and 8.) to ariſe from a greater attrition of the ſolids upon the fluids, and of the fluids upon each other, from an increaſe in the circulation in the inflamed veſſels, as alſo in thoſe veſſels which remain yet pervious, but are more or leſs compreſſed or ſtraitened by the diſtention of the adjacent veſſels which are obſtructed and diſtended. Therefore every medicine will be a cooler, which can remove the too great thickneſs of the fluids, which can relax the obſtructed veſſels, and which can diminiſh the too great impetus of the circulation, and therefore all watery liquors will be ſerviceable not only as diluents, but as coolers at the ſame time. For we obſerve that the habit of body is colder as it contains a larger quantity of water, and, on the contrary, that the blood is hotter as it is leſs

dilute: Hence all dropſical people are cold, but thoſe who are robuſt, and addicted to exerciſe are very warm. But water is alſo ſerviceable at the ſame time, in as much as it relaxes the ſolid parts, as was ſaid in the commentaries on § 35 and 54. Now the blood being diluted with water, and the veſſels relaxed, the force of the circulation is thereby always diminiſhed, as is very evident in weak girls, who ſo frequently fall into diſeaſes from weakneſs, by the abuſe of warm watery liquors. When therefore there are any hopes of reſolving an inflammation, water is to be the baſis of all the antiphlogiſtic medicines, to which farinaceous and emollient ſubſtances are to be added to relax the veſſels ſtill more; and to theſe, attenuating remedies are likewiſe to be joined, to divide the inflammatory concretions, and render them pervious. Various forms of theſe remedies may be compiled, of which you have ſome ſpecimens given in the materia medica, correſponding to this number of the preſent aphoriſm. It is to be alſo obſerved, that bleeding and purging, of which we treated at numb. 2 and 3, of the preſent ſection, are alſo coolers in inflammatory diſeaſes.

6. By quieting the impetus of the blood in the part itſelf, by the external application of remedies, which cool, repel, and aſtringe; to which may be added anodynes and aperients of various kinds, according to particular circumſtances.

Hitherto we have been treating of thoſe remedies which prevent any further injuries of the veſſels, either by making a change in the whole body, or in ſome other of its parts; we are therefore now to treat of thoſe which are capable of reſtraining the too great impetus of the humours, by an external application to the inflamed part itſelf. It was ſaid before in the

commentary on § 382. numb. 8. that the motion of the humours was accelerated, as well by an irritation of the fibres in the inflamed part, as of thoſe throughout the whole body; and therefore every thing which can remove this irritation by being applied to the inflamed part, will reſtrain the impetus of the blood. But this irritation there ariſes, becauſe the ſides of the veſſels are diſtracted by the blood urging behind the obſtructions; and therefore every thing which can remove the obſtructions, and give a free paſſage to heſitating blood, into the open veſſels, may remove this irritation. But ſuch a paſſage may be procured to the blood two ways, either by ſo relaxing the obſtructed veſſels, that the impervious particles may paſs through the extremities into the veins; or elſe by contracting the veſſels in ſuch a manner by things which cool, repel, and aſtringe, as to drive back the obſtructing matter from the impervious ends of the veſſels towards their larger baſes, or into a larger part of thoſe veſſels. This laſt method was frequently uſed for the cure of inflammations by the antient phyſicians, when any part of the body was ſuddenly inflamed, without any apparent cauſe preceding, in which caſe they derived the cauſe of the diſorder from an afflux of humours: And Galen [n], treating on this diſorder, obſerves, that the methodical ſect of phyſicians, and their followers aſſerted, that all inflammations were to be treated with laxatives, becauſe they judged the diſorder to proceed from an aſtriction. For it is to be obſerved, that this ſect of phyſicians derived all diſorders either from a ſtricture, or a relaxation of the ſolids only, in which doctrine they had afterwards many followers. But a little afterwards Galen adds, that both reaſon and experience teach, that after due evacuations the inflamed part is to be treated with ſuch remedies as have a power of repelling the influent humours, and at the ſame time of evacuating thoſe

[n] Method. Medend. ad Glaucon. Lib. II. cap. 2. Charter. Tom. X. pag. 370.

which

which are already contained in the affected part, and ſuch alſo as can reſtore the tone or ſtrength to the affected parts. For theſe purpoſes he recommends the ſempervivum, malicorium, rhus, &c. in which there is manifeſtly a power of cooling and aſtringing. And in the following chapter of the ſame book, he ſays, that it will not be improper to apply ſuch things as moiſten and warm, to thoſe inflammations which ariſe from other cauſes, but which do not proceed ſuddenly from ſuch an afflux.

From what has been ſaid therefore here, and in the commentary on § 300, where we treated of the effects following from the application of things actually or potentially cold to an inflamed part, it appears that coolers are ſerviceable with aſtringents and repellents only at ſome particular times; and that there is ſome caution required in their application, ſince if they do not prove ſerviceable, they may be very injurious. In the ſlighter inflammations they are often very ſerviceable, if applied in the beginning; and thus I have frequently ſeen incipient inflammations of the eyes cured only by the application of cold water. But when the diſorder is inveterate, and the obſtructing matter as it were (to uſe the expreſſion of Galen, cited in § 390.) wedged into the veſſels, it will not then ſuffer itſelf to be eaſily repelled; whence the veſſels being rather contracted in their capacities by theſe remedies, and their humours coagulated, the diſorder will be increaſed: and therefore in ſuch a caſe it will be more proper to apply laxatives and aperients, which open the veſſels, and looſen the obſtructing matter. It is therefore the buſineſs of a prudent phyſician to vary and chuſe his remedies according to particular circumſtances.

It likewiſe ſeems of ſervice in this caſe to take in the uſe of anodynes, or thoſe medicines which eaſe pain. But theſe, as we obſerved in the commentary on § 202. act in a threefold manner; either by removing the cauſe of the pain, or by ſo diſpoſing the

part in pain to which they are applied, that it becomes leſs affected by the painful cauſe; or laſtly by removing the ſenſe of pain, while the cauſe of it remains in the injured part. All the remedies therefore before mentioned will be anodynes, inaſmuch as they remove the cauſes of pain, either by relaxing and opening the obſtructed veſſels, or by repelling the impervious matter from the narrower towards the larger part of the veſſels; or which ſo diſpoſe the affected part, that it is leſs injured by theſe cauſes. But beſides theſe we have alſo a licence to uſe thoſe remedies which remove the ſenſe of pain in the part to which they are applied, provided thoſe means are at the ſame time not neglected, which are capable of removing the cauſes of the pain. Hence the leaves of *hyoſciamus*, *cynogloſſæ*, *&c.* may be added to fomentations to be applied to the inflamed parts: for the effects of violent pain are (as we obſerved at § 226.) fever, heat, thirſt, dryneſs, *&c.* all which are injurious to the inflamed parts, and as many of theſe diſorders ariſe only from the ſenſe of the pain, § 229. numb. 2. it is very evident that much good may be therefore expected from the uſe of thoſe remedies which obtund the ſenſe of pain.

SECT. CCCXCVII.

THE injury itſelf, which is offered to the veſſels, is likewiſe removed by the ſame means (396): for thoſe which have been relaxed by too great a diſtraction will recover their former figure by the natural contractile force of the fibres, and their powers and nutrition will return.

The injury offered to the obſtructed veſſels aroſe from their diſtention by the impulſe of the vital humours urging upon the obſtructed part; and as every thing enumerated in the preceding aphoriſm tends either

ther to diminiſh or to turn off the impulſe of the blood, it is very evident, that the injury may be removed by the ſame means. For ſo long as there are any hopes of obtaining a reſolution, the continuity of the veſſels is not yet diſſolved, even though they are very much diſtracted, ſo that when the obſtruction is reſolved, the diſtracted fibres gradually recover their former dimenſions, and all the diſorder, which then remains, is a weakneſs of the fibres from their having ſuffered too great a diſtraction, (ſee § 25. numb. 3.) which is cured by removing the diſtracting cauſes, (§ 28. numb. 5.) and by reſtoring the loſt ſtrength of the veſſels and viſcera by ſuitable aliments. Now the more firm and elaſtic the veſſels are, which have been diſtended by an inflammation, the ſooner do they return to their former ſhape or dimenſions; and on the contrary more time is required to reſtore the ſtrength of the veſſels in proportion as the inflammation is ſeated in a leſſer ſeries of them. Perhaps one may from hence derive the reaſon of ſeveral appearances, which remain a long time after the cure of inflammatory diſeaſes of the encephalon by reſolution: for it ſometimes happens after a frenzy or a delirium in acute fevers, the ſmall pox, *&c.* that a conſiderable weakneſs remains, or a notable diſturbance of all or ſome of the functions, which depend upon the encephalon, continues even after theſe diſeaſes have been cured. If then the cure of them is attempted by bliſters, purges, ſudorifics, and the like evacuants, or powerful movers of the blood, every thing becomes worſe, whereas by committing them to nature, thoſe maladies in time diſappear of themſelves. The ſame thing is alſo confirmed by that moſt diligent obſerver of nature in the moſt abſtruſe diſeaſes, Sydenham[a]: for he remarks in a continual epidemic fever, which ſuddenly affected the head with a phrenzy, that after general evacuations made by bleeding and purging, a coma was ſometimes left behind,

[a] Schedula Monit. de novæ febris ingreſſu, pag. 661.

which yet diſappeared in time, provided the patient aroſe from his bed daily, and was not moleſted with violent remedies. For in theſe caſes the equable motion of the humours, through the encephalon, ſeems to remain diſturbed, till the veſſels, too much weakened by diſtention, have recovered their former ſtrength.

SECT. CCCXCVIII.

THE obſtructing matter will be reduced to a ſtate of fluidity, if it be attenuated and diluted:

1. By reſtoring the elaſtic vibrations of the veſſels, by diminiſhing the diſtended humours, by plentiful bleeding and purging; by adding a ſtimulus to the fibres, by means of ſome thin aromatic liquor drank very warm; by fomentations, frictions, cuppings, and ſcarifications.

The third thing required in the cure of an inflammation by reſolution, was to add and preſerve a fluid ſtate to the obſtructing matter, (ſee § 395.) We therefore now come to treat of the methods and remedies for obtaining theſe ends; and firſt concerning thoſe, by which the impervious matter is rendered ſo fluid, as to paſs freely through the narrow extremities of the veſſels. But this may be obtained two ways, either by diluting, as when the combined particles of the blood are ſeparated by the interpoſition of water; or elſe by attenuating the matter, by the attrition of the veſſels, with frictions and ſuch remedies, as by the figure and rigidity of their particles may be capable of dividing the concreted parts. Alſo diluents and attenuators may be ſo combined as to produce greater effects by their conjunct powers.

1. Our

1. Our blood naturally tends to concretion by reſt, and this the more as the perſon is ſtronger; a continual motion is therefore neceſſary to alter the ſituation of the particles of the blood, and prevent their concretion; and it is by this ſame motion, that thoſe parts are to be diſſolved, which have once begun to concrete. When a perſon faints away, the blood ſtagnates in the large venous receptacles about the heart, and eſpecially a large quantity is collected in the venous ſinus and right auricle of the heart, and betwixt the lungs, where it begins immediately to be diſpoſed to concretion; but if ſuch a perſon is revived by the aſperſion of cold water, ſoon after a violent palpitation of the heart follows, and the viſcid blood, which began almoſt to form a polypous concretion, will ſtagnate in the ſmall extremities of the pulmonary artery; but upon the contraction of that artery, theſe fleecy concretions will be repelled, and thus will they return backward and forward, till they are at length attenuated and diſſolved by the attrition from the ſides of the veſſel, and thereupon all the anguiſh ceaſes, and the blood has again its free courſe from the right ventricle through the narrow extremities of the pulmonary artery. The ſame effect may be expected, if the inflamed veſſels are reſtored to their elaſtic vibrations, with which they before moved: for if we conſider the cauſes by which our blood is moved in the veſſels, it will appear that its motion muſt be performed even in the inflamed veſſels, which will be firſt diſtended and then contracted again alternately. For when the heart contracts, it expels all the blood contained in its cavities into the arteries, which are already full, and which being flexible will be therefore dilated at the inſtant when the heart is in its contraction, after which the arteries will again contract to their former diameter by the elaſticity and reaction of their muſcular fibres, by which the blood contained in their cavities will be propelled forward; for the valves, placed at the entrance

trance of the aorta, prevent the blood from returning back towards the heart, and therefore it is derived through the arteries into the veins; if now we conceive an obſtacle to be lodged in the cavity of an artery, ſo as to prevent the free courſe of its blood, that artery may be dilated by the impulſe of the blood received from the force of the heart; but that artery cannot contract itſelf again the moment after it has been dilated, becauſe the paſſage of its contained blood into the veins is obſtructed, and the return of it is alſo prevented by the impulſe of the blood urging behind; ſuch an artery will therefore remain full and diſtended, but without motion, becauſe the elaſticity and force of its coats are not ſufficient to remove the reſiſtances. But how can we here reſtore the vibration of ſuch an artery? it may be done barely by diminiſhing the quantity of the diſtending humour; but the obſtructed end of the artery denies a paſſage into the vein, whence there is no other method remaining, but to diminiſh the quantity and force of the vital fluids to ſuch a degree, that the natural contraction of the artery may be ſufficient to prevail, and by that means repel the contained blood towards the baſis of the artery. In that caſe the obſtructing matter, being no longer preſſed by the fluids urging behind, will paſs by the contraction of the artery towards the baſis of that veſſel, unleſs it was ſo impacted in the narrow extremities, as to be quite immoveable, and again the moment after, it will be propelled to its former ſituation in the narrow extremities, from whence an attenuation and diviſion of the concreted particles may be reaſonably expected. But that the concreted blood may thus diſſolve into leſſer particles, ſo as to be capable of paſſing through the narrow extremities of the arteries, has been demonſtrated to the eye, in the experiment of Leeuwenhoeck, which we mentioned in the commentary on § 232. numb. 1. But in what manner the quantity and impetus of the diſtending fluids may be diminiſhed

ed by bleeding and purging, has been declared before at numb. 2. and 3, under the preceding aphoriſm. But how much may be done towards a reſtitution of the oſcillatory motion of the veſſels, too much diſtended with fluids, is evident in plethoric patients, in whom the pulſe of the artery is often ſcarce perceptible, when the plethora has acquired its utmoſt extent: but when the too great quantity of fluids is diminiſhed by a plentiful bleeding, the pulſe ſoon after riſes, and all the functions are reſtored which were before oppreſſed.

By a ſtimulus added to the fibres by means of a thin aromatic liquor drank very warm.] The celebrated Baglivi, in a treatiſe which he has wrote, *De fibra motrice & morboſa*, has demonſtrated, that there is a propenſity to irritation in the ſolid parts of our body, by which their motions may be ſurprizingly diſturbed by the irritation of ſtimuli, whether by increaſing their natural motion, which they uſed to perform according to the laws of health, or elſe by diſturbing it. It appears from the moſt certain experiments that ſtimuli produce this effect in the larger parts of the body. The ingeſted aliments are conveyed by degrees through the ſtomach, and all the convolutions of the inteſtines, till they arrive at the end of the inteſtinum rectum, and being in this long courſe drained of their more ſoluble parts, are at length diſcharged out of the body: but if the inteſtines are irritated by a ſtimulating purge, the ingeſted aliments will then be hurried through the bowels in a ſhort ſpace of time, with a conſiderable diſturbance from an increaſe of the periſtaltic motion. When acrid poiſons corrode the internal ſurface of the inteſtines, they often cauſe them to contract ſo violently, as to be quite ſhut up in all thoſe places where the poiſon touches, whence the elaſtic air being intercepted, enormous tumours of the abdomen have then been obſerved to follow. Even this irritability is ſo ſtrongly inherent in many parts of the body, that they retain it after death, and exert

a mo-

a motion thereby when all the other parts are dead. The obſervation of Lord Bacon, mentioned in the commentary to § 1. informs us, that the heart of a man, who was exenterated, being thrown into the fire, leaped up to a conſiderable height, and continued its motion for the ſpace of ſeven or eight minutes. When Peyerus opened the thorax and abdomen of a cat, when ſhe was ſtiff and dead of an abortion, upon blowing into the receptacle of the chyle, he was ſurprized that the air paſſing to the heart occaſioned firſt its auricles, and then the whole heart to vibrate for ſeveral hours. When the ſame anatomiſt happened to try the like experiment in human bodies, he found it had the ſame ſucceſs, yet ſo that the motion of the heart was more eaſily recalled in ſome than in others: and ſometimes he not only inflated air, which ought to be warm, but he alſo found it neceſſary to uſe an external warmth. He found by experiments that the hearts of thoſe who had been hanged eaſily recovered their motion, and retained it for a more conſiderable time [a]. From all which it is apparent, that the application even of a ſlight ſtimulus to the fibres, viſcera, and veſſels, may excite them to greater motions. When the moſt healthy perſon has taken too large a quantity of ſalt, ſpices, or wine, the heart and arteries will be irritated by thoſe ſtimuli to more frequent contractions, and produce a fever. When therefore the obſtructed veſſels have been a long time conſiderably diſtended by the impulſe of the vital humours urging behind, their fibres are often ſo much diſtracted, that they loſe their force, and do not ſufficiently re-act upon their contained fluid. So ſoon therefore as the quantity and impetus of the diſtending blood has been diminiſhed by bleeding and purging, it will be proper to exhibit ſuch remedies, as by mixing with the blood, and paſſing through the arteries, may irritate their fibres with a gentle ſtimulus, ſo as to contract with a great-

[a] Peyer. Paterg. Anatom. pag. 199.

er force, and by that means break or divide the obſtructing particles ſmall enough to paſs eaſily through the extremities of the veſſels, whence the inflammation will be cured by a reſolution. But to anſwer this intention may ſerve, the milder ſort of ſpices drank by the way of infuſion in a large quantity of water, ſuch as the ligna ſantalorum, ſaſſafras, the five opening roots, *&c.* either infuſed or gently boiled, which can never be prejudicial in ſuch a caſe. Such a form of medicine may be ſeen in the materia medica correſponding to this aphoriſm.

But while theſe remedies are taken plentifully, it will be proper to determine their action towards the affected parts, by fomenting, friction, cupping, and ſcarification; concerning the uſe of all which we treated in the commentary on § 134. But frictions are uſeful in this caſe, as they perfectly imitate and ſupply the action of the veſſels by contraction and relaxation upon their contained fluids. But it is very evident that the frictions are here required to be but gentle, and that they ought never to be uſed to inflamed parts, till the pain and tenſion have been leſſened or removed by evacuating and leſſening the impulſe of the blood.

2. By diluting the impacted matter, by drinking thin and watery liquors warm.

After a large quantity of the humours have been evacuated, and the veſſels reſtored to their vibrations, nothing will be more conducive to cure an inflammation by reſolution, than to fill the veſſels with ſuch a liquor as may very eaſily pervade all the ſmaller veſſels. But ſuch a fluid is water; and the moſt ſubtile parts of our humours, which come under our ſenſes, reſemble water almoſt in every reſpect; from whence it is evident, that water may paſs through even the ſmalleſt veſſels of the body. This fluid therefore drank warm is one of the chief remedies in all inflam-

matory

matory diſeaſes; for being brought by the laws of the circulation to thoſe parts where the obſtructions are formed, it will there inſinuate and dilute, and be intimately mixed with the obſtructing matter by the action of the veſſels; ſo that by interpoſing itſelf betwixt the obſtructing particles, it will ſeparate them from each other, which we call dilution. But what power water has in removing obſtructions by diluting and attenuating, has been declared in the commentary to § 134 and 135. It is to be alſo obſerved, that water ſerves for a vehicle to all the other remedies which are capable of attenuating and diſſolving the inflammatory concretions: and therefore all thin drinks in which water is predominant, are fit for the ſame purpoſe. Such are the whey of milk, milk and water, mild ſmall beer, decoctions of barley, oats, &c. and the infuſions of coffee and tea.

3. By uſing attenuants, reſolvents, and ſuch things as are oppoſite to the nature of the obſtructing matter, applied as well externally as internally in the form of decoction, bath, fomentation, vapour, cataplaſm, emplaſter, or ointment.

Although water can diſſolve many concretes, ſuch as all ſalts, things ſaponaceous, mucous, and gellatinous; yet there are many things which water alone is not capable of diſſolving. For this reaſon ſuch remedies are mixt with water, as are known to poſſeſs a diſſolving power; and of theſe ſuch are to be choſen as are oppoſite to the nature of the obſtructed matter. But the obſtructing matter in this caſe is the red blood, or a thinner impervious humour joined with it, ſtagnating in their proper veſſels, or wedged into other ſmaller veſſels by an error of place: at the ſame time there is alſo a greater motion and heat, which incline our humours very much to a ſtate of putrefaction.

See

See § 84. numb. 4 and 5. and therefore the attenuators of the inflammatory concrete, ought at the ſame time to be very averſe to putrefaction. We are acquainted with ſeveral remedies of this nature, in which there is not only a great power of attenuating and diſſolving, but alſo of reſtraining putrefaction. Honey is one thing which poſſeſſes theſe qualities in a high degree, and which was therefore very frequently uſed in all inflammatory diſorders; for by an immoderate or too long an uſe of this juice, the whole maſs of blood may be ſo diſſolved, as to be evacuated from the bowels under the form of water; and it alſo has the power of preſerving or confecting all parts of vegetables from any manner of corruption. Even Herodotus[b] tells us, that the Babylonians buried in honey. Sugar, which is at preſent ſo much in uſe, is endowed with the like efficacy: to theſe add the recent juices of garden fruits, the roots of ſuccory, goatbeard, vipers graſs, *&c.* all which may be uſed with ſucceſs in the form of a thin decoction. Among the ſaline attenuants, nitre is preferable to the reſt, becauſe they are either alcaline, (ſee § 135. numb. 2.) and therefore diſpoſe our humours more to putrefaction, or elſe they ſo increaſe the impetus of the arterial blood, by their ſtimulus, as to be not eaſily overcome by the action of the veſſels. Various forms of pleaſant medicines may be made with theſe ingredients for internal uſe; and it will be at the ſame time uſeful to apply the like medicines externally to the inflamed part, either in the form of a bath, fomentation, vapours, or cataplaſm. But the external application of theſe remedies ſeems to be not only uſeful, inaſmuch as the water ſaturated with the medicinal particles inſinuates itſelf through the bibulous veins of the ſkin, and mixing with the blood, are by the laws of circulation carried throughout every part of the body, or elſe they may be determined more to the inflamed part, by deriving with attractives or pro-

[b] Lib. I. pag. 80.

pulſives

pulſives (§ 134.) But the like remedies alſo act, inaſmuch as being diluted with water, they inſinuate into and through the arteries themſelves, and by that means apply their force immediately to the obſtructing matter; for that part of the artery which is beyond the obſtruction remains empty, and is not urged by the impulſe of the blood from the heart; and all the branches of ſuch an artery, which ariſe beyond the obſtruction, will be likewiſe empty: from whence that force by which very ſmall tubes attract liquors into their cavities, will cauſe the fluid medicine applied to enter thoſe branches. If therefore the obſtructing particles are plied on all ſides by attenuation, as well externally as internally, and if the elaſtic vibrations of the veſſels are likewiſe reſtored at the ſame time, it is evident that the obſtructing matter will be in a manner diſſolved, provided there is but the leaſt proſpect of a mild reſolution. But the plaiſters and ointments which are applied to the inflamed part for this intention, ought not to be too adheſive, nor to have any conſiderable acrimony, becauſe then they will rather increaſe the diſorder. (See § 376.) Such of theſe are therefore to be choſen, which only adhere gently to the ſkin, and confine the thin exhaling vapours, ſo as to retain the parts affected as it were in a vaporous bath of its own, and by relaxing the bibulous veins to ſuffer the particles of the applied remedies to enter more eaſily.

SECT. CCCXCIX.

THE humours are rendered mild or unacrid by watery drinks, a ſmooth diet, with mild or balſamic medicines, which dilute and obtund, or by ſuch as naturally oppoſe the particular ſpecies of offending acrimony.

It

It was ſaid before in § 386. that a mild or ſmooth diſpoſition of the humours was neceſſary, in order to procure a reſolution of an inflammation; and therefore it is not barely ſufficient to render the obſtructing matter fluid, unleſs the mildneſs is alſo preſerved, or that particular ſpecies of acrimony corrected which attends. Water, and all watery liquors are more eſpecially uſeful for this purpoſe: for nothing is milder than pure water, by which the moſt violent acrimony of any kind may be ſo diluted as to be no longer offenſive. Even the moſt concentrated oil of vitriol, which in a moment deſtroys the part to which it is applied after the manner of actual fire, may be ſo weakened by a large quantity of water, as that it may be ſafely taken into the ſtomach. Now whenever there is an acrimony in the blood, the thirſt which it occaſions directs the patient to drink a large quantity of water, or ſome other thin liquor, until it is evacuated or waſhed out of the blood either by urine or ſweat. The truth of this is experienced even in the moſt healthy people, who have eaten too much ſalted fleſh or the like at their dinner. Beſides this, the drinking of thin watery liquors alſo ſatisfies the reſt of the curative indications, of which we treated under the preceding aphoriſm. The diet which will be moſt conducive to the ſame purpoſe, is to be compoſed of emollient pot-herbs, and ſoft pulſe, ſuch as barley, oats, wheat, rice, *&c.* with milk. Hippocrates nouriſhed his patients in theſe acute diſeaſes with nothing but a drink of barley, as is evident from his book, *De victu in morbis acutis.* The beſt remedies in this caſe are thoſe compoſed of emollients, and things which are gently viſcid or mucilaginous, ſuch as marſh mallows, common mallows, mullen and the like in decoctions, with emulſions of oily and farinaceous ſeeds, the expreſſed oils theniſelves of thoſe ſeeds, and every thing which ſo obtunds and ſheaths acrimony, as to prevent it from doing any injury. But as theſe oils very ſoon become rancid, eſpecially in hot weather,

or by the heat of the ſtomach, therefore emulſions are often preferable, in which there is the ſame obtunding virtue of the oil, and that without any danger of its degenerating into a rancid acrimony. But if there is an acrid cacochymia before the inflammation aroſe, or if the like acrimony is obſerved in the juices after the inflammation is produced, then it will be convenient to uſe thoſe things which are known to be ſpecifically oppoſite to the apparent acrimony: thus abſorbents are to be uſed in the acid ſpecies of acrimony, and alſo in the alcaline, but in a putrid ſpecies of acrimony acids are proper, *&c.*

SECT. CCCC.

A Repulſion of the matter is procured,
1. By a large evacuation of the arterial and venal blood by phlebotomy.
2. By relaxing the fibres.
3. By artificial frictions.

It was ſaid in § 395, where we enumerated the general curative indications to be obſerved for the cure of an inflammation, by diſperſion or a reſolution, that if the obſtructed matter could not be rendered ſo fluid as to paſs through the narrow extremities of the arteries, that there then remained but one method of cure; namely by repelling the matters from the ſmaller extremities into the larger veſſels, where they might be taken up with the common circulation, and rendered pervious through thoſe veſſels which they ought naturally to paſs. This method may take place in every kind of inflammation, but more eſpecially in that kind which ariſes from the larger particles of the blood miſtaking their courſe. That is, when the orifices of the ſmaller veſſels are ſo dilated as to take in larger particles than can paſs through their ſmall extremities. For inſtance, if in ſuch a caſe

caſe a red globule is repelled back out of the ſerous artery into which it entered, it will return into the ſanguiferous artery through whoſe ultimate extremity it may eaſily paſs into the vein, by which the inflammation will be reſolved or terminated. But in order to repel the matter in this manner, it is neceſſary either to remove or very much diminiſh the impulſe of the vital humours, urging upon the back of the obſtruction; and at the ſame time the obſtructed veſſels are to be ſo relaxed, that they may eaſily permit the impacted matter to return back; and laſtly a motion is to be communicated to the impervious particles, which may carry them back towards the larger part of the obſtructed veſſel; but each of theſe are accompliſhed by the means propoſed in the three following numbers.

1. Concerning this you may conſult what has been ſaid in the commentary on § 141. numb. 1.

2. For the obſtructing matter being wedged into a narrower part of the veſſel, if the fibres of that veſſel are rigid, the matter will be held ſo faſt as to be immoveable: It will be therefore proper in ſuch a caſe to relax the fibres, when the impetus of the fluids urging behind, has been firſt diminiſhed, otherwiſe the obſtructed particles will be thruſt further into the relaxed veſſels, which is repugnant to the indication of repelling; for here we are not to attempt a propulſion of the matter through the relaxed veſſels. But in what manner, and by what remedies, the fibres of the human body may be relaxed, has been declared in § 35, 36, and 54.

3. See what has been ſaid concerning the uſe of frictions for this intention, in the commentary on § 141. numb. 2.

SECT. CCCCI.

FROM hence we may be able to underſtand what that ſo much deſirable reſolution is, by which a compleat cure is performed without any criſis (386.) in all inflammatory diſeaſes, whether external or internal.

In whatever parts of the body the inflammation is ſeated, it always retains the ſame definite, or preciſe nature; namely an obſtruction of the arterial veſſels, with a violent impuſe of the vital humours urging on the back of the obſtructions. What is it therefore to reſolve an inflammation? the anſwer is, that it conſiſts in ſo attenuating and dividing the obſtructing particles, which heſitate in ſome arteries, or by ſo relaxing the obſtructed veſſels, as to give the humours a free paſſage through them, which were before impervious; or even ſometimes by repelling thoſe particles back into the larger veſſels. It is evident enough, that this method of curing an inflammation is of all the beſt and ſafeſt, becauſe it reſtores the parts to their healthy functions, without offering any further damage to them. But it is not always in the power of a phyſician to cure an inflammation thus by reſolution; the means required for performing which, have been mentioned in § 386.

Which makes a compleat cure.] A reſolution only can be properly called a compleat cure of an inflammation, which it removes without inducing any other diſorder: whereas the other ways of terminating an inflammation cannot be ſaid to make a compleat cure, ſince they introduce an abſceſs or a ſcirrhus, even though they remove the inflammation; for, in this caſe, there is another diſorder introduced, which will require its particular cure, before the parts can be reſtored to their healthy ſtate. But when an inflammation

mation terminates in a gangrene, or a ſphacelus, it does not then conduce to a cure, but the death of the parts.

Without a criſis.] What is properly meant by a criſis in diſeaſes, and in what manner this word is uſed in various ſenſes among the ancient and modern phyſicians, we ſhall have a better opportunity of explaining hereafter, when we come to treat more profeſſedly on that ſubject in the hiſtory of fevers. It will be ſufficient for us here to obſerve, that an inflammation is ſaid to be cured without a criſis, when the morbific matter, namely the impervious humours heſitating in the arteries, is ſo diſpoſed by the remaining vis vitæ, and the applied remedies, that it is again rendered capable of paſſing through its veſſels agreeable to the laws of health: but when the ſame matter is removed from the narrow extremities of the obſtructed veſſels, and yet has not thoſe conditions, which are required for it to flow through the veſſels with the healthy humours, without injuring the functions, it is then either evacuated from the body, or elſe depoſited upon ſome particular part, and then the inflammation is ſaid to be cured by criſis, and the evacuation and depoſition of the matter is termed critical. For example, when a red globule has entered a ſerous artery by an error of place, and an inflammation thence follows; if that red globule be either repelled back from the ſerous into the ſanguiferous artery, or elſe diſſolved into the ſix ſerous globules of which it is compoſed, according to Leeuwenhoeck, that inflammation will be cured without a criſis, becauſe the morbific matter is ſo diſpoſed as to paſs freely through all the veſſels, which it ought to pervade in a ſtate of health. But if the extremity of the obſtructed veſſel is thruſt off together with its impervious matter, by a moderate impulſe of mild humours urging behind, the obſtruction will be thus removed; but then the humours will be extravaſated from the diſſolution of the continuity of the veſſel,

and the ſeparated end of the obſtructed veſſel with its impervious matter, being no longer obedient to the laws of circulation, is therefore to be conſidered as a foreign body which requires to be diſcharged: ſo that the tender ſolids which are thus ſeparated mixing with the extravaſated humours, are by the heat of the body changed into matter, formed by a mild incipient putrefaction, which matter will therefore require to be evacuated, as it can never be reduced to the ſtate of our healthy juices. And in this manner alſo an inflammation is cured but by means of a criſis; becauſe the morbific matter is firſt changed by the remaining vis vitæ, and then ſeparated and diſcharged from the body. From thence you may plainly perceive the difference between the cure of an inflammation, which is made by a reſolution, and that which is made by a criſis: and this doctrine will alſo appear agreeable to the general axiom which Galen * delivers concering the various events of diſeaſes, *viz. Magni ſiquidem morbi judicantur omnino: quicumque autem parvi, ſolvuntur ſolum*; "That great diſ-"eaſes are always attended with a criſis, but thoſe "which are ſlight are only reſolved." For a ſlight inflammation may be diſperſed, when a violent one terminates either in a ſuppuration or a gangrene.

Of Abscesses.

SECT. CCCCII.

IF theſe means (395 to 401.) are uſed too late, not at all, or without ſucceſs, the inflammation then goes on to ſuppuration (387.) which may be known by the ſigns there (387.) mentioned, and the indications will be

* De Criſibus Lib. III. cap. 4. Charter. Tom. VIII. pag. 433.

1. To

1. To haſten the maturation of the crude matters into one ſmooth humour.
2. To mollify the ſame and the parts adjacent.
3. To draw the matter outwards.
4. To procure a diſcharge to the concocted matter.
5. To mundify or clean the parts.
6. To compleat the cure, as in other wounds.

An abſceſs, termed alſo *apoſtaſis* and *apoſtema*, was uſed in various ſenſes by the ancient phyſicians. For Hippocrates[a] uſes this term to denote the change of one diſeaſe into another, when he ſays, *Ex aliis febribus & morbis abſceſſus in quartanus fiebant*: "Some fevers "and diſeaſes become quartans by abſceſs." He alſo uſed the term abſceſs to ſignify that endeavour of nature by which ſhe ſeparated any offenſive matter from the blood, either evacuating it from the body, or elſe depoſiting the ſame upon ſome particular part: and hence the ancient phyſicians diſtinguiſhed two kinds of abſceſſes; namely, thoſe by efflux, and ſuch as were made by depoſition upon ſome part[b]. Thus, for inſtance, in a peripneumony, the morbific matter was obſerved by them to diſcharge itſelf by ſpitting, a bilious diarrhœa, or a copious and thick ſediment in the urine; in which caſes the abſceſs was ſaid to be by efflux: but when no ſuch excretion was obſerved, and there were nevertheleſs apparent ſigns that the patient would ſurvive, then Hippocrates[c] obſerves, that an abſceſs is to be expected either about the ears, or towards the lower parts of the body, by a depoſition of the morbific matter in ſome place. And in this ſenſe abſceſſes are defined by Galen[d], *Af-*

[a] Epidem. 1. Textu 21. Charter. Tom. IX. pag. 44.
[b] Galen. Comment. 2. in Lib. I. Epidem. Hipp. Text. 44. Charter. Tom. IX. pag. 55.
[c] Prognoſtic. Charter. Tom. VIII. pag. 655, & in Coac. n. 395.
[d] Method. Med. ad Glaucon. Lib. II. cap. IX. Charter. Tom. X. pag. 382.

fectiones illas, in quibus ab invicem ſecedunt, quæ prius ſe mutuo tangebant, corpora. Spatium igitur in medio vacuum fieri neceſſe eſt, quod materiam aliquam flatulentum aut humidum, aut ex utraque miſtam, continebit. Mutantur autem in abſceſſum & inflammationes quædam, & Eryſipelatoſi Phlegmonondeſque tumores non pauci, &c. "To be thoſe diſorders in which the parts of the "body before cohering, recede from each other. "There muſt be therefore of neceſſity a void ſpace "made betwixt the parts, which ſpace will contain "either a moiſture, or flatus, or a compoſition of "them both. But many tumours of the phlegmo-"node and eryſipelatous kind, and ſome inflamma-"tions, are changed into an abſceſs," *&c.* For when the obſtructed ends of the inflamed veſſels are ſeparated by the impulſe of the humours acting behind, they mix with the extravaſated juices, and by the warmth of the parts change into matter, which by removing the contiguous parts, makes itſelf a paſſage: but as a true phlegmon is almoſt conſtantly ſeated in the panniculus adipoſus only, that membrane by its eaſy yielding, may be ſometimes diſtended to a very great degree by the matter which it contains. But that ſuch a preternatural cavity is formed by the confined matter, after the phlegmon is ſuppurated, and that it did not before exiſt, is evident, inaſmuch as by inciſing the inflamed part with a lancet before any matter is formed, the whole tumour appears ſolid, and diſcharges only blood or a thin ichor: but when ſuch a part is wounded after a ſuppuration is formed, and the matter diſcharged, there appears a manifeſt cavity, made by the receding of the parts which were before contiguous.

There is no room to doubt, that the method of curing an inflammation by reſolution is of all the beſt; but as this is frequently not in the power of the phyſician or ſurgeon, then a ſuppuration only remains, ſince it is evident enough, that the other methods of terminating an inflammation, namely, in a gangrene

or ſchirrhus, are much worſe. If therefore it ſhall appear from the ſigns mentioned in § 387. that the inflammation is of ſuch a nature, that a reſolution cannot be expected, or if there were ſome hopes at the beginning, but by a neglect or a perverſe treatment continued for many days, the obſtructions are confirmed in ſuch a manner, that the matter is quite irreſolvable, then the curative indications direct ſpeedily to promote a ſuppuration, to remove all thoſe parts of the ſolids and fluids, which have been ſo changed, as to be no longer obedient to the laws of the circulation; and when this is performed, the loſt ſubſtance may be regenerated, and the parts united which were ſeparated from their natural coheſion. But this is what we are to conſider in the following numbers of this ſection.

1. So long as the material cauſe of a diſeaſe continues of ſuch a nature, as to either continue or increaſe the diſtemper, it is termed crude; but when it has been ſo altered by the remaining vis vitæ, its own natural diſpoſition, or the uſe of proper remedies, ſo as to be leſs remote from the laws of health, and to produce leſs diſturbance in the functions of the body, it is then ſaid to be concocted; and that ſtate of the diſeaſe, in which its material cauſe is thus altered, ſo as to be leſs offenſive, is called the time of maturation or concoction. This crudity may therefore take place both in the ſolid and fluid parts, and ſo may likewiſe its alteration or maturation; but in a plegmon all the obſtructing matter is called crude, which cannot be reſolved, and alſo every veſſel which is ſo obſtructed that it cannot be opened. In order to reſtore health therefore, ſuch obſtructed veſſels with their impervious contained matter, ought to be ſeparated from the reſt of the living and pervious veſſels, and by mixing afterwards with the extravaſated humours, to be formed into laudable matter. So long therefore as the ends of the impervious veſſels remain unſeparated, the vis vitæ urging on the back of the obſtruc-

obſtructions, will increaſe all the inflammatory ſymptoms, (See § 381, 382.); but when this ſeparation is once made, as the humours will then have a free paſſage through the broken ends of the veſſels, it is ſufficiently evident, that all thoſe ſymptoms muſt be very much diminiſhed. Crudity is therefore known by the intenſity or increaſe of all the ſymptoms; but maturation is diſcovered by the remiſſion of them. This is very well expreſſed by Celſus[e], where he treats of abſceſſes: *Crudum eſt autem, in quo major quaſi venarum motus eſt, & gravitas, & ardor, & diſtentio, & dolor, & rubor, & durities; &, ſi major abſceſſus eſt, horror, atque etiam febricula permanet: penitiuſque condita ſuppuratione, pro his, quæ alioqui cutis oſtendit, punctiones ſunt. Ubi iſta ſe remiſerunt, jamque is locus prurit, & aut ſublividus, aut ſubalbidus eſt, matura ſuppuratio eſt*; "But the matter is crude when the "arteries have a greater motion accompanied with a "heavineſs, burning, diſtention, pain, redneſs, and "hardneſs of the parts; and if the abſceſs is large, a "ſhivering and ſlight fever continue: but when the "ſuppuration is finiſhed, inſtead of theſe there are "pricking pains, which otherwiſe point out the part "of the ſkin affected; and when thoſe pains grow "more remiſs, and the part itches and looks blueiſh, "or whitiſh, the ſuppuration is then mature."

2. The hardneſs or reſiſtance of inflamed parts ariſe from the great compactneſs of the ſolids and fluids. (See § 382. numb. 4.) and ſo long as they continue, the diſorder may be juſtly termed crude. But maturation requires a ſeparation of the ends of the obſtructed veſſels from the other ſound parts; and therefore the more thoſe veſſels are mollified and in a manner diſſolved, the ſooner, and with leſs pain will they be ſeparated. But if a violent phlegmon has invaded a part, we generally obſerve that all the circumference of the tumour remains hard, even though the middle of the part affected turns ſoft; and there-

[e] Lib. V. cap. 28. n. 11. p. 327.

fore

fore the adjacent parts of the tumour are to be fomented with emollients, as Celsus observes, when he says, *Si qua circa duriora sunt, ad ea mollienda, vel malva contrita, vel fæni græci linive semen ex passo coctum superdandum est*; "If there are any adjacent "parts harder than the rest, they are to be mollified by "the application of bruised mallows, or the seed of "fœnigræc, or linseed boiled in sack."

3. If matter should be formed by suppuration in the inflamed part, which is seated in the external surface of the body under the skin, the skin is then usually elevated into a tumour, and this more especially if the part is fomented with emollient and relaxing medicines. But if the inflammation is more deeply seated, there will be more danger, lest the matter should make itself sinuses in the adipose membrane, or if it is seated in some of the internal parts, it may corrupt the viscera with a putrid tabes. So soon therefore as it appears from the signs mentioned in § 387. that the inflammation tends to suppuration, then all the endeavours of art are to be used to draw the matter to some external part. Celsus [c], in treating of the cure of a pleurisy, recommends bleeding for a severe pain which is recent, but when that remedy is used too late, or proves fruitless, he says, that then, *Confugiendum est ad cucurbitulas, ante summa cute incisa. Recte etiam sinapi ex aceto super pectus imponitur, donec ulcera pustulasque excitet; & tum medicamentum, quod humorem illuc citet, &c.* "Recourse "is to be had to cupping-glasses before the skin is "incised. It is also right to apply mustard and vine-"gar upon the breast, till it has excited blisters or "sores, and then to use a medicine which may stir "up the humour, and direct it thither, *&c.*" In a peripneumony, when the disorder is increased to the highest, he observes [b]; *Prodesse etiam impositum super pectus salem bene contritum, cum cerato mistum: quia*

[c] Lib. V. cap. 28. n. 11. pag. 328. [b] Lib. IV. cap. 6. pag. 209, 210.

leviter

leviter cutem erodit, eoque impetum materiæ, qua pulmo vexatur, evocat. Utile etiam aliquod malagma est ex his, quæ materiam trahunt: "That it may be also ser-
" viceable to apply salt finely ground and mixed
" with cerate to the breast, because it gently cor-
" rodes the skin, and by that means calls off the vio-
" lence of the matter which injures the lungs. It is
" also useful to apply a cataplasm of such things as
" draw matter." If now the matter formed can be conveniently drawn outwards, the event of the inflammation need not be so much feared; for patients often die after a suppuration from a pleurisy, while the ulcer full of matter does by its tumour pressing inward obstruct the lungs, and produce suffocation, or else by breaking, deposits its matter into the cavity of the thorax; whence an empyema, consumption, and death. But if an abscess formed about the ribs, should point outwards, and cause a tumour in the external skin, a happy cure generally succeeds by opening the tumour, and discharging the matter. Therefore, for these reasons, the antient physicians applied irritating substances to stimulate the external parts, or else they fomented the parts with emollient cataplasms and fomentations, to derive the impetus of the disease outwards.

4. When the ends of the obstructed vessels, together with their impervious blood mix with the adjacent humours, and by the warmth and stagnation in a close place form a white fat and uniform liquor, it is then said to be concocted matter; but by what signs, one may know that such a matter is present, we shall explain hereafter at § 405. But when this matter is contained a long time in a close and warm place, it becomes gradually thinner and more acrimonious; and as there are small absorbing veins which open throughout the whole surface of the cavity in which the matter is confined, it will be drank up by those veins, and conveyed into the mass of blood, whence it will occasion a purulent cachochymy, whence a hectic

fever

fever and consumption follow. Besides this the matter rendered more acrimonious will corrode the whole surface of the part in which it is contained, and being at the same time attenuated, it may very easily make itself new passages in the panniculus adiposus; from whence sinuses and fistulæ of the worst kind often follow, barely for want of procuring a timely discharge to the concocted matter. And from hence again the difference betwixt curing an inflammation by resolution and suppuration is sufficiently apparent. For when the inflammation is resolved, the matter of the disease is so scattered by the remaining vis vitæ, and proper remedies, that it becomes very much like the healthy humours with which it flows, through all the vessels without injury to any of the functions; and therefore no evacuation is required. But when a separation is made of those solids and fluids, which the inflammation has destroyed, they then turn into laudable matter; which yet is a liquor quite foreign to the nature of our humours, and by mixing with them disturbs all the functions, and excites a fever, until it is either evacuated from the body, or else separated from the blood, and translated to, or deposited in some particular part of the body; from whence again it must be evacuated, in order to perform a cure. It is therefore evident, that an evacuation of the concocted matter is necessary, and that in due time, since it always becomes acrimonious by long standing. But what ill consequences may follow when matter is too long confined in an abscess, we are taught by practical observations. A maid of forty years old had a suppuration of the left parotid, so that on the fourteenth day of the disease there was an abscess as large as one's fist. But as no fever attended in the beginning of the disorder, and she every day followed her domestic business, yet as the confined matter was not timely discharged, it produced a fever, attended with the worst symptoms, such as faintings, vomitings, watchings, &c. of which she expired a few days after.

after. The abſceſs was indeed broke ſeveral days before death, but little or no matter was diſcharged[h]. In a child of three months old there aroſe an abſceſs about the right ſhoulder; but as the parents would not allow it to be opened, the tumour naturally ſubſided of its ſelf, but the abſorbed matter being tranſlated to the genital parts, it there produced a fatal gangrene[i]. There are many obſervations of the like nature, which demonſtrate how dangerous it is to leave concocted matter confined for too long a time in a vomica or abſceſs.

5. So long as the part ſuppurated remains cloſe, it is termed vomica clauſa or an abſceſs, but when a diſcharge of the matter has been procured either by art or nature, the diſorder is then termed a vomica aperta or an ulcer. But the whole internal ſurface of the cavity, in which the matter was contained, is more or leſs infected by the matter, eſpecially when that has been confined a long time, and rendered more acrimonius by heat. It is not therefore poſſible either to procure a conſolidation or union of the parts, nor a reſtitution of the loſt ſubſtance, before the whole ſurface of the cavity is firſt reduced to the ſtate of a clean wound. Therefore the half dead extremities of the veſſels, and half corrupted parts of the panniculus adipoſus muſt be firſt ſeparated, and all the reſt performed in the manner we directed in the hiſtory of wounds, § 206 to 209. Hence Hippocrates tells us, *Ulcera non purgata coire nolunt, etiamſi adducantur; neque etiam ſponte coaleſcunt. Ulcera etiam, quorum circumpoſitæ partes inflammantur, coire non poſſunt, quamdiu non ceſſaverit inflammatio. Neque, ſi ambientes ulcus partes denigratæ fuerint, aut ſanguis putreſcens, aut varix ſanguinis influxum ſuppeditans adfuerit, talia coire poſſunt, niſi circumſtantes ulceris partes ſanas*

[h] Hildan. Obſerv. Chirurg. Centur. I. Obſerv. 30. pag. 39.
[i] Ibid. Obſerv. 81. pag. 59.

effeceris:

effeceris: " that foul ulcers will not unite, even " though they are retained together; nor will they " conjoin of their own accord. Ulcers likewiſe, whoſe " circumjacent parts are inflamed, cannot unite, as " long as the inflammation continues. Nor can ſuch " ulcers be healed or conjoined, if the circumjacent " parts are black, beſet with putrid blood or accom- " panied with a varix, which bleeds, all which will " prevent the union, unleſs you reduce the circum- " jacent parts of the ulcer to their healthy ſtate [k]."

6. After the ulcer has been depurated, it acquires the nature of a clean wound; and then a regeneration of the loſt ſubſtance, and an union of the parts ſeparated, may be procured.

SECT. CCCIII.

THE maturation is performed by applying ſuch things as,

Increaſe the motion of the humours in the part, by fomenting, ſtimulating, and warming materials, which either warm actually or virtually; and the uſe of the like remedies in the whole body, may be ſerviceable by exciting a fever.

The maturation of all crude inflammatory matter into concocted pus, muſt be performed by the remaining vis vitæ; for when the ſtrength of life is defective or languid, no matter is formed: and therefore *Hippocrates* [l], reckons the appearance of dryneſs in an ulcer, either before or in a diſeaſe, among the ſigns of death. It is alſo from a weakneſs of the vital powers, that the ſpitting is diminiſhed, or even frequently quite ceaſes in the latter end of a pulmo-

[k] Hippocrat. de Ulcer. cap. 4. Charter. Tom. XII. pag. 132.
[l] In Prognoſticis Sentent. 22. Charter. Tom. VIII. pag. 605.

nary

nary conſumption. But the vis vitæ is eſtimated or meaſured by the force of the circulating humours through the veſſels; and as the obſtructed ends of the veſſels with their impervious contained matter are to be ſeparated by the impulſe of the humours acting behind, it is evident that this ſeparation will be ſooner performed, if the ſtrength and ſwiftneſs of the blood's motion is increaſed through the veſſels of the part to be ſuppurated; for then the circulating fluid will ſtrike more frequently and ſtrongly in a given time againſt the obſtructed ends of the veſſels, and ſeparate them ſooner from their coheſion. Hence it is that we enumerated an increaſed motion of the humours, among thoſe conditions (§ 387.) which cauſe an inflammation to tend to ſuppuration. But it is to be obſerved, that too great a velocity of the humours ſuddenly excites a rupture in the veſſels, and does not procure a gradual ſeparation of their ends; whence a gangrene follows inſtead of a mild ſuppuration, as was obſerved before at § 388. A juſt medium is therefore here required, ſo as to keep up the motion of the humours greater than in health; but not to let them move too violently. But the heat of the inflamed part, when it is ſeated in the ſurface of the body, or a more or leſs fever when it is ſeated internally, will demonſtrate whether the motion of the humours ought to be increaſed or diminiſhed. Therefore the motion of the humours, if defective, is to be excited by the application of topical remedies to the affected part, and by the uſe of internal medicines. And as we obſerved in the comment to § 371. that an inflammation is accompanied with a fever either in the whole or in the particular part of the body, ſo it will be alſo neceſſary to increaſe the motion of the blood, either in the inflamed part only, when that can be done; or elſe throughout the whole body, by exciting a ſlight fever. Thus we ſee in conſumptive patients that there is a ſlight fever always invades the patient every day, while the matter is forming; but

which

which fever diminiſhes when the formed matter is ſpit up. Therefore Hippocrates has pronounced in the place we before cited, in the comment on § 387. *circa puris generationes dolores & febres magis accidere quam pure facto:* "that the pains and fever are more in-"tenſe, about the time when matter is forming, "than after it is compleatly formed." In the materia medica correſponding to this ſection, the aromatic gums are recommended to us, ſuch as ammoniacum, galbanum, opopanax, *&c.* in all which there is a moderate ſtimulus, and at the ſame time a ſufficient degree of tenacity, by which they adhere to the part where they are applied, and thus by confining the very ſubtle exhaling vapours, they keep the part as it were in a vaporous bath of it's own, and at the ſame time their aromatic ſtimulus inſinuates into the relaxed veſſels; and hence it is that the application of theſe remedies has often ſuch happy effects, when a ſcirrhus is feared from too weak a motion of the humours. But all theſe things which excite a greater motion in the affected part, by ſuch a mild ſtimulus, have alſo the virtue of warming or heating; becauſe a greater heat ariſes from an increaſed motion of the humours through their veſſels, as was demonſtrated in the commentary on § 382. numb. 6. Thoſe things are alſo very ſerviceable, which are actually warm, provided they are not applied ſo hot, as to diſſipate the more fluid parts of the humours, and convert the remaining parts into the hardneſs of a ſcirrhus. Therefore the beſt of all, in this caſe, will be to apply warmth with moiſture, namely, to foment the part to be ſuppurated by the uſe of cataplaſms and fomentations, ſecured with hot woollen cloths or the like, to retain the parts in a gentle and conſtant heat. For as Hippocrates [m] ſays, *calidum ſuppuratorium, non in omni ulcere, maximum ſecuritatis ſignum: cutem emollit, extenuat, dolorem ſedat, &c.* "a ſuppurat-"ing heat is not a ſign of the greateſt ſucceſs in every

[m] Hippoc. Aphor. 22. Sect. V. Charter. Tom. IX. pag. 207.

" ulcer, though it mollifies and extenuates the ſkin, " abates the pain, &c." but why Hippocrates ſays, not in every wound or ulcer, is explained by Galen, in his commentaries to this aphoriſm; namely, becauſe hot things are hurtful to putrid and running ulcers, by increaſing their putrefaction, and attracting their flux of humours.

2. The heat and motion excited in the part, are there confined by preventing too great an exhalation, and diſſipation of it, by conſtipating or glutinous ſubſtances, and diminiſhing the too great acrimony.

The inflamed part is always hotter than is uſual in health (ſee § 382. numb. 6.) and as all the ſymptoms of the inflammation increaſe, when it tends to ſuppuration (ſee § 387.) therefore the heat will be increaſed while the heat is forming. But by an increaſe of heat, the more fluid parts of our humours are diſſipated, as will be evident from the commentaries on § 689; therefore it will be extremely ſerviceable to apply ſuch things as continually moiſten as well as warm the affected part, to reſtore thoſe thin vapours which are continually diſſipated by the increaſed heat. Thoſe remedies will be therefore beſt which contain a large quantity of water, and which do not eaſily ſuffer it to exhale again, and ſuch are all glutinous ſubſtances, which with water are capable of forming a ſoft paſte, ſuch as all meals, and eſpecially that of linſeed, which is capable of imbibing a large quantity of water. Of theſe and ſuch like ſubſtances may be formed cataplaſms, which are very emollient, of which there are various forms given in the materia medica, correſponding to this aphoriſm. If theſe are involved on all ſides about the part to be ſuppurated, and ſuffered to continue there day and night, eſpecially if care be taken to keep them warm; it is uſual for any irreſolvable inflammation to ſuppurate and be converted into

into laudable matter; but as all these remedies mollify as well as moisten and relax the solid parts, they very much diminish the pain, attending a suppuration often in no small degree (see § 228. numb. 1.) and they mitigate all acrimony, by sheathing and obtunding; therefore they are likewise serviceable inasmuch as they conduce to that mild disposition of the humours, which is required towards a suppuration, as was said in the commentary on § 317. but as there is here no small danger of a putrefaction in the humours which stagnate in the obstructed vessels (see § 84. numb. 4, and 5.) promoted by the increased heat and quicker motion of the humours, through those adjacent vessels which remain pervious, therefore such substances are to be chose, which are soon altered into a disposition opposite to that of putrefaction, by the heat of the part to which they are applied; that is to say, which easily turn sour. Hence it is, that surgeons add rye flour, vinegar, sorrel, and the like substances, which soon turn acid, in the composition of their maturating cataplasms: and to these, they usually add also fresh butter, linseed oil, or the like very soft fat substances, partly because they prevent too great a dissipation of the moisture from the cutaneous pores; and partly because, by this means, the cataplasm is prevented from drying and growing hard too soon.

3. By moderating the motion of all the vital humours, and their temperature, so that they may neither be sluggish nor excited too much.

This rule is of the greatest moment in the practice of physic, as well in the cure of internal as of external diseases. An increased motion of the humours, causes an inflammation to tend to suppuration (see § 387.) but too violent a motion of them causes a sudden destruction of the very tender and minute vessels, and produces a gangrene (see § 388.) But in the resolution of an inflammation the motion of the humours is

but moderate, (ſee § 386.) So long therefore as there is hopes of a reſolution, the phyſician or ſurgeon boldly diminiſhes the impetus of the vital humours, by the remedies mentioned at § 396. in order to prevent any further injury from being offered to the inflamed veſſels: but when the ſigns denote that it is impoſſible to reſolve the inflammation, then it is required to give the humours a greater motion than they had naturally in a ſtate of health, in order to ſeparate the obſtructed ends of the veſſels, and convert them with the extravaſated humours into laudable matter; from whence it is evident, that in ſuch a caſe it may be often prejudicial to uſe thoſe things which weaken the force of the circulation. It is therefore here neceſſary ſo to moderate the courſe of the humours through the veſſels, as to make them paſs with a greater heat and motion than is uſual in health, either by the exhibition of medicines internally, or by the application of topical remedies to the affected part, where the ſuppuration is to be made: but yet theſe remedies ought not to be ſo violent, as to deſtroy all the vital influx of the humours, by ſuddenly burſting the veſſels, that is, ſo as to produce a gangrene. That the humours flow thus moderately, may be known, if the heat of the inflamed part does not much exceed the heat of the blood in health; if a pain attends, but not violent; if a moderate pulſation is perceived, together with a tumour, redneſs, and the other ſymptoms of inflammation gradually increaſing: and by the appearance of theſe ſigns in the affected part, we are informed whether the vital motion of the humours ought to be increaſed or diminiſhed. But when the inflammation is ſo great as to diſturb the whole body, then the intenſity of the fever, thirſt and dryneſs of the tongue, eaſily demonſtrate what ought to be done to moderate their violence. There is therefore no univerſal ſuppurating medicine; but different remedies are required, according as the motion of the humours is to be either increaſed

creaſed or diminiſhed. To promote a ſuppuration in the body of a young perſon of a warm habit, it will be proper to apply a cataplaſm of oatmeal, milk and freſh butter; but in old people of a melancholic or cold habit, it will be proper to add roaſted onions, galbanum, gum ammoniacum, and the like moderate ſtimulators, that by gently increaſing the motion of the humours a ſuppuration may the better ſucceed in the inflamed part, and prevent a ſcirrhus; which laſt is too often the conſequence of an inflammation, that is too languid in ſome glandular part. The ſame doctrine is alſo true in regard to internal inflammations. Thus, in the beginning of a pleuriſy, a very bold uſe of the lancet continued till the patient faints, often removes the diſeaſe; but when the phyſician, being called too late, perceives that it is no longer poſſible to procure a reſolution, it then remains to concoct or digeſt the morbific matter, and diſcharge it either by ſpitting, urine, or ſome other evacuation; or elſe, finally, to convert it into an abſceſs. And at that time bleeding, and other evacuations which too much weaken the vital powers, are always prejudicial; ſince, in ſuch a caſe, a moderate fever is required to maturate the crude matter of the inflammation.

4. The inflamed part is not to be opened till all is ſuppurated, which remains irreſolvable. For by theſe means laudable matter is made in the part.

It frequently happens in the larger abſceſſes, that the center of the ſuppurating part appears ſoft and yielding to the fingers, while in the mean time, the greater part of the tumour which is inflamed, continues hard in all its circumference. But as many bad conſequences may follow, by confining the matter too long in a cloſe place, after it has been formed, as we ſhall explain more at large in the commentary

on § 406. therefore ſurgeons uſually make haſte to open ſuch tumours, even when they perceive but a ſmall fluctuation. But all the diſorders which have been obſerved to follow too long a confinement of the matter, proceed either from the acrimony or putrefaction, which it, by that means, acquires; and as the quantity of it gradually increaſes, it eats new paſſages into the panniculus adipoſus, and produces ſinuoſities and fiſtulous ulcers; or elſe a purulent cacochymy is produced in the blood from an attenuation and abſorption of the matter taken up by the bibulous veins; or laſtly, the more fluid parts of the matter being diſſipated, the reſt thickens and produces ſcirrhous tumours, eſpecially in the glandular parts. But ſo long as the part remains not opened, and no acceſs is given to the air, the matter does not ſo ſoon degenerate into a putrid ſtate; but being confined within its cavity by the hard circumference of the tumour on all ſides, it cannot eaſily burrow into the panniculus adipoſus: nor can there be any great danger of the matter's being abſorbed, ſince the arterial veſſels which are diſtended with an irreſolvable inflammatory matter, compreſs the adjacent veins. Beſides this, the matter lodged in an abſceſs, which is but thus half maturated, makes one of the beſt remedies, by which all the adjacent, or as yet hard and crude matter, may be diſſolved or conſumed. [a] Hippocrates has a ſentence of the like nature, which we mentioned in the comment on § 323. *Neceſſe eſt, carnes contuſas & laceratas in pus verſas tabeſcere:* "Contuſed and "lacerated fleſh muſt neceſſarily be diſſolved and "changed into matter." Thus it was alſo obſerved in the commentary on § 158. numb. 7. that the matter formed in a wound diſſolved the lacerated fibres and extremities of the inflamed veſſels, with their obſtructing matter. It is therefore evident, how uſeful it muſt be not to open the ſuppurating part, till all

[a] De Vulner. Capit. cap. 14. Charter. Tom. XII. pag. 121.

the

the crude inflammatory matter is brought to maturation: for thus we imitate nature, who most happily accomplishes the suppuration of what ought to be changed into matter, while the integuments of the part remain whole. In like manner, after the parts have been divided by a recent wound, and the hæmorrhage is over, a bloody crust is then formed upon the surface of the wound, which is cleansed by a mild suppuration under that crust. And hence Hippocrates[b] every where observing the dictates of nature, lays it down as a medical axiom, *Quæcumque concoqui oportet, occludi convenit; contraria vero exsiccare & aperire:* "That whatever is required to be concocted, "ought to be shut up from the air: but when the "intention is contrary, we are to open and dry up "the parts."

If now every thing is put in practice, which we have enumerated in the four preceding numbers, then laudable matter will be formed in the part: but what the conditions of good and laudable matter are, has been said in the commentaries on § 387.

SECT. CCCCIV.

UNless the inflammatory matter is thus altered or maturated, it will be both dangerous and unsuccessful to make an opening of the abscess.

For if the tumour is opened before the matter of an inflammation is brought to maturity, mere blood is then discharged instead of matter, as we said in the commentary on § 382. numb. 2. or, if the matter is but in part suppurated, by discharging that, the rest will be indurated, and cannot so soon and so easily be brought to maturation. Besides this, when tumours are laid open by incision in their crude state, they always excite more severe pain, and there is greater

[b] Epidem. Lib. VI. Textu 34. Charter. Tom. IX. pag. 416.

danger of injuring the ſubjacent parts, by perforating the ſkin. For in a mature abſceſs, the confined matter elevates the ſkin from the ſubjacent parts; and therefore an opening may be more eaſily made by the lancet, when its ſharp point enters into a cavity full of matter; whence there will be no danger of injuring the veſſels, or muſcular fibres. Hence Celſus[a], in treating of abſceſſes, which are formed in nervous parts, ſays, *Sed cætera etiam ſubcruda aperiri poſſunt; inter nervos ultima exſpectanda maturitas eſt, quæ cutem extenuet, eique pus jungat, quo proprius reperiatur:* "But though in other tumours which are in ſome "meaſure crude, an opening may be made; yet a-"mong the nerves or tendons, the laſt degree of ma-"turity is to be waited for, whereby the ſkin may be "extenuated, and come into contact with the matter, "as it points more outward." The ſame will be alſo true in thoſe places, in which there are large blood-veſſels ſeated, as in the groins and armpits, in which there are inflammatory tumours frequently formed, tending afterwards to ſuppuration. For no prudent perſon will open ſuch an abſceſs before the maturation is compleated, becauſe the large veſſels, or their conſiderable branches may be eaſily injured, to the hazard of the patient's life, when they are opened too ſoon. But how much the cure will be retarded, and the pains augmented, if an abſceſs is opened while crude, is evident from the obſervations of the beſt ſurgeons. For a very painful and inflammatory tumour was formed after a fever in the axilla of a certain nobleman; the ſurgeon who attended, was urged by more prudent advice to open the tumour with a lancet, as ſoon as he perceived a ſlight fluctuation, which was performed with no ſmall pain to the patient, who was not at all relieved by the ſmall diſcharge of matter, but on the contrary, the fever and inflammation were increaſed. The diſorder was afterwards cured by a long continued uſe of emollient ca-

[a] A Corn. Celſ. Medic. Lib. VII. c. 2. pag. 409.

taplaſms,

taplasms, though it might have been cured in a few days time, if the tumour had not been injudiciously opened before its maturation was compleated. The same thing is also proved by many more instances, alledged by the celebrated le Motte [b], whom we have so frequently quoted. Thus I have sometimes seen venereal buboes, which being opened too soon for fear of a confirmed lues, have occasioned the greatest difficulties, and often proved incurable for several months; the surgeons being obliged to consume them by caustics, when the same thing might have been prevented with certainty in a few days time, by letting the matter continue longer confined in the parts. But it is to be observed, that the outward margin in abscesses has often some degree of hardness, while the rest is perfectly brought to maturity: now when such tumours break of their own accord, and discharge all their matter, those hard remains are usually melted down and discharged in a few days time. It will not be therefore prejudicial to open such tumours, as have the greatest part of them suppurated.

SECT. CCCCV.

THAT the matter is formed and fit to be dischaged, is known by the softness of the part, a fluctuation and whiteness of the pressed tumour, a remission of the pain, heat, redness, tension, pulsation, and fever, instead of which a dull or heavy pain succeeds, and the tumour forms a prominent point.

Since therefore it is dangerous to open a tumour, which tends to suppuration, before it is perfectly maturated; and as many bad consequences may also follow, if the formed matter is too long confined and

[b] Traité complet de Chirurgie, Tom. I. pag. 211, &c.

shut

ſhut up, as we ſhall declare under the following aphoriſm; therefore it is neceſſary to give a diligent attention to thoſe ſigns which inform us, that the matter is ſo far advanced and collected in an abſceſs, that it may be ſucceſsfully diſcharged by opening. But theſe ſigns are deduced from the alteration of thoſe appearances which happen in the affected part, while the irreſolvable matter is ſuppurated, even until a perfect maturation is compleated.

A ſoftneſs of the part.] It was demonſtrated in the commentary on § 382. numb. 4, that a conſiderable hardneſs in a phlegmon proceeded from the ſolids and fluids being violently compacted together, becauſe the inſpiſſated blood ſtagnated in the obſtructed veſſels, which were as yet intire. But when the diſtended veſſels are burſt open, and their humours extravaſated in the ſuppuration of a phlegmon, the tender ſolids are then torn off, ground together, and diſſolved in the humours, ſo as to form matter, (ſee § 387.) whereupon a ſoftneſs conſequently follows, by a converſion of the inflammatory matter which was before hard and crude, into a yielding fluid under the entire ſkin. For there may be a conſiderable hardneſs in bodies, which are even compoſed for the moſt part of fluids, provided the juices are contained in diſtinct veſſels, and not accumulated together into one part; of which we have an inſtance in apples, pears, turnips, *&c.* for though theſe fruits have an incredible quantity of juice, yet they often appear very hard; but by bruiſing, or by dreſſing with fire, they turn into a ſoft pulp; becauſe then the elaſtic air concealed in thoſe fruits, being rarified by heat, breaks their veſſels, and extravaſates their humours, inſomuch that the hardeſt apple is thus ſoftened to ſuch a degree in a quarter of an hour's time, that it runs or ſpreads about. The ſame thing alſo happens, when the continuity of the veſſels in ſuch fruits is diſſolved by putrefaction.

Fluctuation

Fluctuation of the preſſed tumour.] That ſurgeons may be aſſured whether or no the inflamed part is uniformly ſuppurated, they uſually apply their fingers to each ſide of the tumour, preſſing it gently firſt to one ſide, and then to the other: and if then they perceive a fluctuation or undulating motion of the contained humour upon the ſide oppoſite to that which they preſs'd, they then know that the whole compaſs of the tumour is ſufficiently maturated. But when no ſuch fluctuation can be perceived, even tho' the tumour appears ſoft on all ſides; then there may be ſome crude inflammatory matter in its middle, which may hinder the motion impreſſed on one ſide of the humour, from being communicated to the oppoſite ſide. But that there are ſuch abſceſſes which are in a manner divided in the middle by a crude matter there ſeated, while there is a perfect maturation in their circumference, we are taught by chirurgical obſervation; and even Hippocrates [a] has obſerved the ſame, when he ſays, *Tubercula foras protuberantia, in acumen ſublata & faſtigiata, & æquabiliter commatureſcentia, neque in ambitu dura, & deorſum tendentia, neque bifida, meliora (ſunt.) Contrari mala, & quæ plurimum contraria, peſſima:* "Tumours which pro-" ject outwards, and form a point after the pain is " abated, and which are not hard in their circumfe-" rence, but uniformly maturated and tending down-" wards without a diviſion in their middle, theſe are " of the better kind: but the contrary ſort are bad, " and thoſe which are the moſt contrary are the " worſt." Alſo Galen [b], in his commentaries on this text, obſerves, *In bifidis medium non ſine vitio inveniri, crudum (ἀνεκπύητον) nempe & durum:* "That " in tumours which are thus divided, the middle is " obſerved to have one fault, namely, a part that is " crude and hard." It is indeed true, that a mature

[a] Epidem. Lib. VI. Textu 13. Charter. Tom. IX. pag. 375.
[b] Ibid. pag. 376.

abſceſs

abſceſs has this fluctuation in common with aneuriſms, and ſome veſicular tumours which contain juices; but yet an abſceſs is very well diſtinguiſhed from theſe, inaſmuch as it follows from an inflammation preceding. But it is ſufficiently evident, that this fluctuation cannot be eaſily perceived by preſſing upon the tumour, unleſs it is protuberant; for when an abſceſs is lodged deeply in the panniculus adipoſus among the muſcles, it cannot be eaſily diſcovered by this ſign.

Whiteneſs.] It was demonſtrated in the commentary on § 382. numb. 1. and 2, that redneſs accompanies an inflammation, becauſe the obſtructed veſſels are diſtended with red blood, together with the panniculus adipoſus; and therefore when the impacted inflammatory matter, together with the ends of the obſtructed veſſels, paſs into white and uniform matter, then the cauſes of the increaſed redneſs will be removed. Beſides this, while the matter is derived outwards, with the application of emollient cataplaſms or fomentations, they extenuate the ſkin; which therefore becomes waſted, and acquires a white colour. For when the exhaling vapours of the ſkin are confined by the application of a plaiſter, they moiſten the ſkin ſo much, that in a few days time it appears white; and by degrees the ſubjacent white matter appears through the extenuated ſkin, which conduces to render it of that colour. From hence therefore the reaſon is evident, why a white colour is juſtly enumerated among the ſigns of a mature abſceſs. Celſus[e], in treating of abſceſſes, takes notice, *Et, quod de ſubito durius non eſt, melius eſt: & quod, quamvis rubet, coloris tamen in album mutati eſt: quæ ſigna jam pure oriente naſcuntur: tumor enim ruborque multo ante incipiunt:* "That the tumour which does not immediately appear harder than uſual, is of the better "ſort, and ſo is that which having looked red, has "yet altered its colour to a white, which affords the

[e] Lib. V. cap. 28. n°. 11. pag. 326.

"proper

" proper signs of forming matter: for the tumour and " redness begin much earlier"

Remission of the pain, heat, redness, tension, pulsation, and fever.] All these signs of inflammation are produced by the impulse of the blood received from the remaining *vis vitæ*, by which it urges against the ends of the obstructed vessels, with an increased force and velocity; (see § 381.) and the reason of all these we gave in the commentaries on § 382. Therefore after the ends of the obstructed arteries have been separated by a suppuration, the cause of these symptoms will be removed, or at least be very much diminished; and therefore Hippocrates justly observes, that the pain and fever are greater about the time of the matter's forming, than when it is already formed, (see the passage cited from him in the commentary on § 387.) But it must be observed, that sometimes the most acute pain continues, even though the part to be suppurated has acquired a perfect maturation, and this because the confined matter daily increasing, gradually distends the superincumbent skin; but this pain immediately ceases, when the abscess either breaks spontaneously, or is opened with a lancet. Therefore Celsus [d], having enumerated the signs by which the crudity of an abscess is discovered, (see the commentary on § 402. numb. 1.) immediately subjoins, *Ubi ista se remiserunt, jamque is locus prurit, & aut sublividus aut subalbidus est, matura suppuratio est:* " When these " signs are diminished, and the part begins to itch, " or appear blueish or whitish, the suppuration is then " mature." For it must be observed, that though the skin generally appears white when the abscess is mature, yet the cutaneous vessels are sometimes so much compressed by the distending matter, that by the destruction of the vital influx and efflux of the humours through them, the skin acquires a livid colour, and becomes gangrenous. Almost the same signs of a maturation of an abscess are related by

[d] Lib. V. cap. 28. n°. 11. pag. 327.

Ægi-

Ægineta *; for he says, after enumerating the signs which denote that the inflammation tends to suppuration, *Consummato abscessu, plurima (horum) minuntur, punctura autem pruriginosæ fiunt, & torpor sentitur, & tumor in apicem acutum elevatur, tangenti lenis & cedens, & superficies circa apicem abraditur* (ἀποσύρεται): "After the abscess is formed, many of these symptoms are diminished, a pricking or an itching follows, a torpidity is felt, and the tumour is elevated into a sharp point, soft and yielding to the touch, and the surface about the point of the tumour is gradually abraded." He well remarks the manner in which the skin is gradually eroded by the confined matter extending to the point of the abscess.

The tumour forms a prominent point.] When a phlegmon tends to suppuration and maturity, there is almost constantly a softness and fluctuation perceived in the middle, even though the circumference remains as yet hard; but as it is usual to apply emollient cataplasms to promote the suppuration, therefore the relaxed integuments usually give way in their center to the matter which is gradually formed, by which they are extended above the equable surface of the tumour; since in the other parts of the tumour, its greater hardness prevents its easy extension. For this reason therefore the tumour will be formed with a point outwards, in which place the integuments being gradually weakened and distended, the abscess will there break of its own accord, or may be most safely opened by the lancet.

A dull or heavy pain.] It was said a little before, that the pain increased as long as the inflammation lasted in the suppurating parts: for the ends of the obstructed vessels are to be gradually broke off, and therefore when the nervous fibres dispersed thro' the coats of the vessels, are the nearest to breaking, the pain will be the most acute, (see § 221.) but will cease when they have been quite broke asunder. But

* Lib. IV. cap. 18. pag. 64.

then

then there will be matter formed, from the juices extravaſated in ſome preternatural cavity which they make, or elſe collected in ſome natural cavity dilated; and by the weight of the matter diſtending the parts, there will be a dull or heavy pain, as if cauſed by a weight. For though a healthy perſon does not perceive the weight of his own body, yet when the humours are extravaſated and collected, he will immediately perceive a heavineſs or pain of wearineſs. When the blood is collected in the panniculus adipoſus, after a rupture of the veſſels under the entire ſkin, from ſome violent contuſion, the patient immediately complains of an unuſual heavineſs, or uneaſineſs in the part, (ſee § 320. numb. 2.) When the ſerum accumulated in the dropſy called *anaſarca* diſtends the legs, the patient draws them after him as if they were made of lead. But it is very evident, that this ſenſe of heavineſs can take place only when the ſuppuration is large; it being one of the principal ſigns of a latent abſceſs from an internal diſeaſe, if after an acute pain, the patient perceives the ſenſe of an internal weight preſſing upon the affected ſide, as will hereafter be made evident in the pleuriſy, peripneumony, and the like diſeaſes, when we come to treat of them particularly.

SECT. CCCCVI.

IF now the matter be left a long time confined in the part, it becomes attenuated, putrified, augmented, and erodes or conſumes the adjacent parts, by which with its quantity, weight, and motion, it creates ſinuſes and fiſtulæ of different kinds in different parts of the body, but the worſt in or near the inteſtinum rectum. Or elſe the more thin juices of the matter being diſſipated, the reſt is indurated, and forms hard tumours,

tumours, more especially seated in glandular parts; or lastly, the matter being absorbed by the lymphathic veins, or else pressed into the mouths of the eroded blood-vessels, it then mixes with the blood, which it infects, and being collected in the viscera, consumes them with abscesses of the worst kind, disturbs their functions, and by that means produces an infinite number of diseases of the very worst kind.

After it has appeared from the signs mentioned under the preceding aphorism, that all the crude inflammatory matter is brought to maturity, and changed into a laudable matter, then that matter ought to be discharged as soon as possible: for when once the matter is arrived to its last perfection, being white, thick, smooth, uniform, and inodorous; from that time it begins gradually to degenerate, and is every day altered for the worse. For the matter is not contained in the vessels, nor is it any longer obedient to the laws of the circulation, but stagnates, and by the warmth of the parts, naturally inclines to a state of putrefaction. For the parts of animals putrefy, though confined in a close place, cut off from any communication with air, only they corrupt then more slowly. We also observe, that all our humours become thinner by putrefying matter; for though blood immediately congeals after it is taken from a vein, yet at length it entirely dissolves when it begins to putrefy. The cystic bile, which is always thicker in healthy quiescent animals, does yet become thin and fluid by putrefaction. Therefore when clean and laudable matter is too long confined in an abscess, it loses its unctuosity, and balsamic thickness, by which it almost resembles the cream of milk, and is changed into a thin ichor; but this great tenuity arising from putrefaction, is always accompanied with a greater acrimony, as we said in the commentaries on § 86: the whole

whole internal ſurface therefore of the cavity, in which the attenuated and acrid matter is confined, will be continually macerated and corroded by the ſharp ichor; the ends of the ſmall veſſels will be diſſolved, and their extravaſated humours will acquire the ſame kind of corruption; ſo that the ſides of the containing cavity being continually eroded, the ſinus of the abſceſs will be always increaſing, and the quantity of matter will be enlarged, by the humours derived thither from the eroded veſſels. There are innumerable and evident obſervations to be found in the moſt approved authors, which prove that the ſolid parts of the body may be conſumed or corroded by the matter, which has been too long confined and rendered putrid. The lungs have been ſo much conſumed after an empyema, that there were ſcarce any remains of that important viſcus to be ſeen, as we read in Schenckius[a]. The ſame author alſo has an obſervation of the compact ſubſtance of the heart itſelf, and its pericardium diſſolved or corroded by matter[b]. And moſt ſurgeons lament frequently, that the ſolid bones are corroded and rendered carious by corrupt matter in deep ſuppurations, &c. Hence the reaſon is evident why Hippocrates[c] pronounced that thoſe empyematic patients might recover, in whom there is a diſcharge of white and pure matter, after the operation performed either by inciſion or cauterization; but that if the matter was diſcharged bloody, filthy, and ill ſmelling, they muſt periſh. As[d] he alſo obſerves in an abſceſs of the liver, that the patient will periſh if a foul matter is diſcharged when he makes water; for in that caſe the ſubſtance of the viſcera being corroded by the matter, renders the caſe extremely dangerous.

[a] Obſervat. Medic. Lib. II. pag. 251.
[b] Ibid. p. 274.
[c] Aphor. 44. Sect. 7. Charter. Tom. IX. pag. 315.
[d] Ibid. Aphor. 45. Sect. 7. pag. 316.

Beſides this, as an inflammation is the moſt frequently ſeated in the tunica adipoſa, as we ſaid before at § 374; therefore a ſuppuration ariſing from the inflammation, will be ſeated in the ſame part. But the very tender fabric of this membrane may be very eaſily corroded by matter which is become acrimonious; even the matter may ſo diſtend this very eaſily dilatable membrane by its weight and bulk, that it may make itſelf new paſſages and ſinuſes of the worſt kind. In the commentary on § 244 and 300. numb. 5. it was demonſtrated, that the air entering the panniculus adipoſus, ſometimes produced a ſurpriſing emphyſema or windy tumour, in which the whole body was in a manner buried; from whence it appears, that there is a ready paſſage from any one part of this membrane into all the reſt of its extent. Thus I have ſeen, for want of diſcharging the matter which was formed by a ſuppuration of the parotide gland, that it has made itſelf a way downward, through the panniculus adipoſus of the neck to the ſhoulder, arm, and even to the bending of the elbow: inſomuch that the ligaments which connect the articulation of the elbow were ſo corrupted, that it afterwards produced an incurable anchyloſis. An abſceſs was formed after a deep inflammation, round the articulation of the femur; and as the matter concealed under the large muſcles could not be evacuated, it deſcended and formed a ſinuous ulcer, running thro' the whole length of the thigh and leg: whence the robuſt youth was deſtroyed by a purulent cacochymia, after ſuffering the moſt tedious afflictions, and trying all means to no purpoſe. If now we alſo conſider, that the matter collected in the cellular membrane is attenuated by the warmth and ſtagnation, and that it often lies under ſtrong muſcles, it is very evident, that being preſſed by the motion of thoſe muſcles, it may be propelled through all the adjacent parts, and by that means produce ſinuſes and fiſtulæ of the worſt kind, more eſpecially when the matter inſinuates into

into the cellular membrane, which is interpoſed betwixt the muſcles themſelves. Now as the tunica adipoſa is of a greater thickneſs, or as there are a greater number of ſtrata of muſcles lying over each other above the ſuppuration, ſo much the worſe ſinuſes or burrows may be formed by the too long confined matter. And hence it is, that ſuch troubleſome fiſtulæ and ſinuſes are ſometimes obſerved in the abdomen, by reaſon of the great quantity of fat there ſeated and interpoſed betwixt the ſeveral ſtrata of the abdominal muſcles, as we obſerved before in the commentary on § 307.

There is no part of the body in which there are worſe fiſtulæ and ſinuſes formed by matter being too long confined, than about the inteſtinum rectum. For as the groſſeſt fœces muſt paſs through that inteſtine to be diſcharged, it was neceſſary that it ſhould be capable of an eaſy dilatation every way; and therefore there is a large quantity of ſoft fat placed all round this inteſtine, into which the confined matter which has been too long retained in an abſceſs, may penetrate and form ſinuſes: for as Hippocrates [a] obſerves, *Putreſcens enim mollia depaſcitur, quum inteſtinum rectum humidum ſit, et caro mollis, in qua pabulatur, donec tuberculum rumpatur, et infra verſus inteſtinum rectum computreſcat:* "The matter corrupting "eats away the ſoft parts, becauſe the inteſtinum "rectum is moiſt, and its parts ſoft, in which the "abſceſs burrows, until the tumour breaks, and pu-"trefies downwards towards the inteſtinum rectum." If now the rectum itſelf is alſo corroded, the matter may ſpread itſelf through the cellular membrane, and mucilaginous cryptæ, *&c.* of that inteſtine, ſo as to produce moſt tedious maladies, which are ſtill much increaſed by the foulneſs of the inteſtinal fœces which are to paſs this way. Hippocrates fearing theſe diſorders, would not have a maturation of the tumour to

[a] Hippocrat. de Fiſtulis, cap. 1. Charter. Tom. XII. pag. 141.

be waited for, but would have it opened as ſoon as poſſible, even though crude [f].

Or by diſſipation of the more thin juices, *etc.*] This ſometimes happens to an abſceſs, though but ſeldom, and eſpecially when it has been treated with very hot medicines without the addition of emollient and moiſtening ingredients. Thus it is cuſtomary with the women to expoſe a ſuppuration of their breaſt to the heat of a burning coal, to avoid having the abſceſs opened by the lancet of the ſurgeon. In that caſe the more thin juices being diſſipated, the remainder is compacted into a ſcirrhus, which will be in danger of turning to a cancer as long as the patient lives; which change of it does but too often happen. The like hardneſs frequently remains after venereal buboes have been opened before their time of a complete maturation, or which have been treated with remedies too hot. The caution of Galen [g] is therefore here ſeaſonable, which he gives in treating on the cure of a phlegmon or an erysipelas, when a ſcirrhus might be feared from thoſe diſorders; for he ſays: *Quod ſi quis vehementur trahentibus et diſcutientibus medicamentis vacuare tentet, nec iis, quæ humectent et calefaciant, molliat ac liquet; huic paucis primis diebus pulchre ſucceſſiſſe curatio videbitur; illud vero, quod de affectu reſtabit, inſanabile erit. Si quidem toto, quod in eo erat tenuium partium, diſcuſſo, quod reliquum eſt, velut lapidoſa concretio linquetur.* "But if any one attempts to evacuate with medicines "which draw or diſcuſs too violently, without adding "thoſe which moiſten as well as warm, and mollify as "well as diſſolve, he will imagine the cure goes on "very well for the firſt few days, but yet that which "is left of the diſorder, will prove incurable. For "all that matter being diſcuſſed, which conſiſted of "thin particles, the remainder is left like a ſtony con-"crete."

[f] Ibid. cap. 2. pag. 142.

[g] Galen. Method. Med. Lib. XIV. cap. 4. Charter. Tom. X. pag. 322.

Or

Or lastly in the sanguiferous or lymphatic veins, *etc.*] It was said before in the commentary on § 158. numb. 7. that matter was formed in wounds by an extravasation of the humours from the broken ends of the vessels, which were inspissated either by a dissipation or absorption of their more fluid parts by standing. For if a wound is cleansed every hour, we shall not find any matter but only a thin humour, which would become matter within the space of twelve hours. But the more fluid parts of the extravasated humours seem rather to be absorbed by the mouths of the veins, than to be dissipated externally; because laudable matter is not usually formed, unless the wound is well covered by some plaister or ointment, and we know that there are the mouths of the divided veins, as well as of the small arteries opening throughout the whole surface of the wound, which may drink up the contiguous juices by that power with which very small glass tubes attract liquors, and by transmitting them afterwards to the larger veins, those humours may at last mix with the blood. In the same manner likewise when matter has been too long confined in an abscess, it naturally becomes much thinner, and putting off it's mild balsamic nature, it becomes acrimonious, and then being absorbed by the contiguous orifices of the veins, it infects the blood with a purulent cacochymy, whence a hectic fever and a consumption follow. But that matter confined in any cavity of the body, may be thus absorbed by the mouths of the veins, and mixed with the blood, we are taught by many observations. A certain nobleman was shot through the fore-arm with a bullet in the time of battle, by which the bones of the cubitus were fractured, whence a continual fever and many bad symptoms followed, and at the same time a large abscess invaded the wounded and adjacent parts. When the surgeons were about to open the abscess which they now thought mature, the patient was seized with a profuse diarrhœa, and immediately all the tumour of the limb subsided, a large quantity

of matter being visibly discharged in the patient's stools. And when afterwards there was more matter formed in the abscess, upon a return of the diarrhœa, that matter also disappeared, and in this manner was that dangerous wound cured. [h] Sculletus [i] tells us, that he saw a large quantity of matter voided with the urine, in a man who was wounded in the abdomen, by which all the symptoms were relieved. Galen [k] also observed an abscess of the lungs voided by urine, and one of the thorax discharged by stool. A vomica of the lungs attended with a distortion of the spine, has been observed [l] to be cured by a purulent dysentery continued for several days; and this notwithstanding the weakness and many bad symptoms, persuaded the most expert physicians, that there was no further hopes remaining; and the girl was not only in a manner snatched from the jaws of death by this flux, but also the distortion of the spine amended of itself. In the small pox how often do we observe, that the absorbed matter excites a fever of the worst kind? and that afterwards the matter being deposited in different parts of the body, suddenly produces tumours, which being opened, discharge a true matter, and sometimes degenerate into ulcers of the worst kind. In short, there are an infinite number of observations given us by authors of the best credit, which demonstrate that matter being too long confined, may be absorbed by the veins and mixed with the blood, so as to be afterwards deposited in several other parts of the body: it is also evident from those observations, that the event of this translation is very doubtful and various, according to the nature of the particular parts, in which the matter is deposited from the blood. For though in the preceding cases, the matter was happily discharged by urine or stool, yet there was always great

[h] Belloste Chirurg. d'Hopital. part. 3. chap. XV. pag. 264.
[i] Armament. Chirurg. Observ. 61. pag. 245.
[k] De Locis Affectis, Lib. VI. cap. 4. Charter. Tom. VII. pag. 517.
[l] Acad. des Sciences l'an 1731. Mem. pag. 724, &c.

danger

danger of its corrupting ſome of the viſcera, or of depraving the whole maſs of blood with which it mixes, ſo as to produce incurable diſeaſes. For the matter which is collected in an abſceſs, which is not opened, can ſcarcely be abſorbed, until it is firſt attenuated, and rendered acrimonious, and when it afterwards flows with the blood through the veſſels, it acquires a ſtill greater acrimony, whence fevers of the worſt kind, a corruption of the blood itſelf, and an infinite number of diſeaſes follow. From hence we often obſerve in the ſmall pox, that when every thing is thought to be ſecure, a high phrenzy ſuddenly ariſes, by which the patient is ſoon taken off unexpectedly; namely, from an abſorption of the matter, and a tranſlation of it to the brain. Hippocrates [m] relates the caſe of a patient, in which there ſeems to have been ſomething of this nature. For he deſcribes the patient as afflicted with an internal ſuppuration of the thorax, accompanied with a ſtertor, or weeſing, which with the difficulty of reſpiration, ſeemed to indicate that a large quantity of matter was collected within. But, ſays he, *prope ſexageſimum autem diem oculus ſiniſter cum tumore excæcatus fuit, ſine dolore: neque longe poſtea etiam dexter oculus, pupillæque admodum candidæ et ſiccæ fiebant, neque multo poſt hanc excæcationem mortuus eſt, non ultra ſeptem dies, cum ſtertore et multa deſipientia*; "about the ſixtieth day the "left eye was blinded with a tumour, but without "pain: nor was it long after before the right eye and "its pupilla, became very white and dry, and in a "little time after this blindneſs, not more than ſeven "days, the patient expired with a ſtertor and light-"headedneſs." For it ſeems very probable that the abſorbed matter was by an unhappy tranſlation carried firſt to the eyes and then to the brain, by which it deſtroyed the patient. It is therefore evident, that different diſeaſes will ariſe according to the particular na-

[m] Epidem. Lib. VII. Ægrot. 30. Charter. Tom. IX. pag. 565.

ture of the viſcera, upon which the matter is depoſited; and as the ſame matter either compreſſes or corrodes the adjacent parts, which lie contiguous, it may either diſturb or totally deſtroy their functions. From hence it is alſo evident, that the greateſt prudence is required in conducting this matter; for if the abſceſs be opened before it is arrived to maturity, it may occaſion many bad conſequences, as was ſaid in the commentary on § 404. but if a diſcharge is not produced to the formed matter, then alſo the moſt fatal conſequences may attend. But the ſigns of a perfect maturation, with the treatment neceſſary to procure it, were deſcribed in the preceding aphoriſm.

It is from this abſorption of the matter that thoſe ſo frequently periſh, who have received a large wound, which daily affords a large quantity of matter, as when an aneuriſm has been cut out, or a limb amputated, *&c.* For if in theſe caſes the matter be frequently wiped off from the ſurface of the wound, where it is collected, the body will be deprived almoſt of all its nouriſhment, which will be that way diſcharged, ſo as to deſtroy the patient with a true maraſmus; but if the matter is left longer upon the ſurface of the wound, by being abſorbed, it will produce a purulent cacochymia, with all its conſequent maladies, unleſs the matter is waſhed out from the blood with which it is mixed, by drinking large quantities of deterging vulnerary decoctions. But ſometimes the patient's ſtrength is ſo weak as not to be capable of bearing a large quantity of ſuch decoction, without being thrown by them into a dropſy, and in that caſe the event is almoſt conſtantly unhappy.

SECT.

SECT. CCCCVII.

THE integuments of the part ſuppurated, with ſuch as are adjacent muſt be mollified, attenuated, and relaxed within and without, by the application of the ſame remedies (403.)

When an inflammation cannot be cured by a mild reſolution, the beſt method that then remains, is to procure a ſuppuration, to obtain which, thoſe curative indications are required, enumerated at § 402. and compriſed there in ſix numbers. For in the firſt place the crude inflammatory matter is to be brought to a perfect maturation: concerning which we are now to treat, as alſo concerning the ſigns, by which we may be aſſured, that the maturation is compleated; and in the preceding aphoriſm, we enumerated thoſe ill conſequences which are to be feared, when a mature abſceſs full of laudable matter is not opened in time. The ſecond curative indication was to mollify the part to be ſuppurated, with thoſe adjacent, ſee § 402. numb. 2. concerning which we are to treat at preſent in this aphoriſm.

We obſerved that an inflammation is moſt frequently ſeated in the panniculus adipoſus or cellular membrane, as it is ſometimes called, (ſee § 374.) which membrane is covered externally with a thick ſkin and its cuticle, both which are to be cut through, or naturally divided, in order to make a way for the diſcharge of the matter, whence it readily appears, that it is in this caſe highly neceſſary to relax and mollify the integuments. But thoſe remedies which were recommended in the commentary on § 403. for bringing the crude inflammatory matter to maturity, will alſo be ſufficient for this purpoſe. For thoſe glutinous ſubſtances recommended at numb. 2. of that aphoriſm, which ſtop up the pores, have alſo at the ſame time a power

power to relax and mollify the ſolid parts. While therefore ſuch cataplaſms or fomentations are applied externally, to the part to be ſuppurated, the integuments are as it were macerated and diſſolved without, while at the ſame time, the matter excited to action, produces the ſame effect within; all which is ſtill further promoted by that heat which invades the ſuppurating part, (ſee § 403. numb. 1.). Nothing more therefore ſeems to be neceſſary to accompliſh this curative indication.

SECT. CCCCVIII.

ALSO by theſe means (407.) the reſiſtance of the integuments is diminiſhed, while at the ſame time, the matter formed by the maturative remedies (403.) is either drawn or thruſt outward.

The matter now formed, and confined in a cloſe place, in which it is daily increaſed, being preſſed by the adjacent parts, will by the laws of fluids tend that way where it meets with the leaſt reſiſtance. If now the integuments are ſo much weakened or relaxed by the application of the moſt emollient remedies, that they may very eaſily give way to the diſtending matter, that matter will elevate the integuments and tend outwards, without making itſelf any ſinuous paſſages into the adipoſe membrane. All thoſe remedies therefore which were recommended for maturating the crude matter of the inflammation, will alſo attract or give the formed matter a tendency outwards. For it was proved in the commentaries on § 134. that attractive remedies were ſuch as diminiſhed the reſiſtance in any part, towards which the humours were to be derived.

SECT.

SECT. CCCCIX.

AND then things which are moderately acrid, emollient and oily, are to be mixed and applied together, that the dead integuments may be more easily opened and without pain.

A discharge is to be procured to the matter confined under the integuments, which therefore requires them to be divided, either by perforating with a lancet, or else by a spontaneous and gradual laceration made by the distending matter. But to effect this with the least pain, the most emollient and oily substances are to be applied, by which the integuments may be so extenuated, as to be almost destitute of sense, like a dead part. Therefore when an abscess is almost arrived to a state of maturity, and rises up to a sharp point, surgeons usually apply a pledgit spread with basilicon or some other very soft ointment, to mollify the integuments in the most protuberant part; for by thus relaxing the fibres, the pain is diminished, (see § 228. numb. 1.) which is generally severe enough in that prominent part of the tumour. Sometimes also there is a quantity of some moderately acrid substance mixed with the emollients, as yeast, Venice soap, honey, *&c.* which in some degree erode or destroy the macerated integuments, and occasion them to divide sooner. Thus washer-women who have been macerating their hands all day in strong soap-suds, have the skin of their fingers white and almost dead, insomuch that it frequently peals off. Forms of such like remedies as are here required may be seen in the *Materia Medica*, corresponding to this aphorism.

SECT.

SECT. CCCCX.

IN the next place the matter being diſcreetly preſſed towards the riſing part of the tumour, the ſcalpel or lancet is then to be entered into the lower part of the whiteſt, ſofteſt, and moſt prominent point of the abſceſs, until the diſcharge of matter demonſtrates that the knife has entered ſufficiently deep, which is then to be raiſed in an even manner ſo as to cut through the integuments with a longitudinal inciſion, or elſe by entering the point of the knife through the oppoſite part of the tumour, the middle of the integuments are to be cut through, avoiding at the ſame time the fibres and veſſels: after this the abounding matter is to be gently preſſed out, at ſeveral times ſucceſſively, taking care not to offend the wound either by admitting the air, or by the uſe of tents.

When the whole circumference of the part appears ſufficiently mollified, and all the ſigns denote that the maturation is compleated, if then the integuments do not open of their own accord, a diſcharge of the matter is to be procured by art, to prevent it from induceing thoſe conſequences which we mentioned at § 406. But in glandular parts an abſceſs is to be left longer before it is opened than in other parts, becauſe there is here greater danger of a ſcirrhus, if any part ſhould be left behind, which has not yet been brought to a maturation. Hence Celſus [a] in treating of the opening of abſceſſes obſerves, *ſi pus maturuit, in alis quidem et inguinibus raro ſecandum eſt: item ubicumque mediocris abſceſſus eſt: item quoties in ſumma cute, vel etiam carne vitium eſt, niſi feſtinare curandi imbecillitas*

[a] A. Corn. Celſ. Medic. Lib. XII. cap. 2. pag. 408, 409.

cogit,

cogit. Satisque est cataplasmatibus efficere, ut per se pus aperiatur, nam fere sine cicatrice potest esse is locus, qui expertus ferrum non est. "If indeed the matter should "come to maturity in the arm-pits or in the groins, "it ought seldom to be discharged by incision: and "the same is also to be universally observed when the "abscess is but moderate, and when the disorder is "seated either in the external skin or in the fat, unless "the weakness of the patient should require it to ex-"pedite the cure. It is in these cases sufficient to ap-"ply cataplasms, by which the matter may make its "own way; for the part which has not suffered the "action of the knife or cautery may remain with lit-"tle or no scar after the cure." From whence it appears, that the spontaneous aperfion of the abscesses is not only preferable when they are seated in glandular parts, but also when they are in danger of producing any deformity by a scar. But then a wound made by a lancet may be afterwards better healed, than if a larger portion of the skin was to be destroyed, or wasted by the contained matter. But why Celsus should observe that an unsightly scar often remains after an abscess has been opened by an instrument of iron, is very apparent from what follows in the same place: for when the matter is lodged very deep, he orders the abscess to be opened by an actual cautery; and otherwise when the skin is very much extenuated, he would have all that part of it cut out which covers the matter. He likewise extirpates the skin in the same manner when it looks pale; for then he says it will become dead and useless, and will be therefore more commodiously cut off.

To procure a discharge to the matter which is collected in a mature abscess, we must endeavour to perform it with as little trouble to the patient, and with as little danger and injury to the adjacent parts, as we possibly can: for we are to divide no more than the common integuments, which are distended and elevated by the matter confined beneath. Hence it is usual for

for ſurgeons to preſs very gently with their fingers upon the whole circumference of the ſuppurated tumour, in order to make the integuments recede as much as poſſible from the ſubjacent parts: and as ſome part of the tumour is generally raiſed to a point, as was ſaid at § 405. therefore the ſcalpel is to be entered principally into that part as the integuments are there more extenuated, and being almoſt dead, they may be eaſily perforated almoſt without pain, eſpecially if that point of the tumour has been before treated by the application of moderately acrid and fat ſubſtances, as we directed under the preceding aphoriſm. But to do this with the more advantage, the inferior or moſt depending part of the tumour is to be choſe for the aperture, that the matter may be diſcharged by its own weight: but in this, attention muſt be alſo given to the poſture which the part will require after the opening has been made. For as Celſus [b] obſerves, *Danda (enim) opera, ut imus ſinus exitum habeat; ne quis humor intus ſubſidat, qui proxima et adhuc ſana rodendo ſinuet*; "for we muſt endeavour "to let the ſinus have an opening at its bottom, leſt "any humour ſhould be confined within, and inſinuate "itſelf farther, by corroding the adjacent parts, which "are as yet ſound." But if the point of the abſceſs is arrived at maturity in its upper part, and the integuments appear there ſofteſt and whiteſt, it will be beſt to make the opening in that part, rather than in one which is more depending, but has its ſkin as yet inflamed and very painful, ſo that it cannot be divided without frequently producing much trouble to the patient and the ſurgeon. For the opening being made, the matter may be entirely diſcharged from the abſceſs, and prevented from making any ſinuous paſſages through the panniculus adipoſus, by changing the ſituation of the part with a gentle compreſſion, and a

[b] Celſus ibidem.

judicious

judicious application of compresses and bandage, according to the nature of the part.

So soon as the knife has penetrated the integuments, it enters into the middle of the purulent matter, which then immediately discharges itself by the sides of the knife, more especially if the integuments were at the same time stretched by a gentle pressure upon the subjacent matter. But when there is a very large quantity of matter, it is best to enter the knife pretty deep, that the wound may be afterwards enlarged, by an even incision made in elevating its point. For the same reason likewise, when it may be safely performed, the knife is thrust from one side of the prominent part of the abscess to the other, and then by elevating it, the superincumbent integuments are divided at once to make the opening the larger, which can never be prejudicial. For unless the opening is made thus large, very great portions of the cellular membrane will be thrust out, almost in a gangrenous state, together with the matter, whence the aperture will be obstructed, and a new incision again required. Add to this, that when the matter is discharged, the integuments which were before distended, will be contracted into wrinkles, so as to very much diminish the opening which has been made, and therefore it may be taken almost for a general rule, always to make the incision as large as possible, in the opening of an abscess, provided it can be done without danger of injuring the subjacent parts. But when the matter is lodged immediately under the skin, it is very evident that then there will be no need to enter the knife to any considerable depth. But sometimes the greatest caution is necessary, when the matter is concealed in parts very remote from the skin: for it will be bad to make an incision upon an abscess without obtaining the discharge required, but it will be often more dangerous to enter the knife deeper into the part, than was at first thought necessary, and therefore in such difficult cases the skill and dexterity of the surgeon are more necessary and apparent.

For

For unleſs he is well acquainted with the ſituation of the parts from anatomy, he will be always trembling either with a vain fear, or elſe with a raſh aſſurance he will deſpiſe the danger of which he is ignorant. For as an inflammation is ſeated moſt frequently in the panniculus adipoſus, as we have ſeveral times obſerved before, and as that membrane inſinuates itſelf betwixt all the muſcles, it is evident that the matter may ſometimes lie very deeply concealed without cauſing any apparent defect in the integuments. The ſigns of a deep inflammation having proceeded, and having been afterwards attended with the ſigns of a conſequent ſuppuration, with a fluctuation of the matter upon preſſing the part, will afford ſome light into thoſe obſcure places. A very remarkable caſe of this nature is related by the celebrated Le Motte [e]. A woman was confined to her bed for nine months after a ſuppreſſion of her lochia, being obliged to continue with her body inflected, in order to leſſen the very acute pains; for ſhe always continued in the ſame poſture day and night, with her heels drawn up towards the nates, and her face bowed down to her knee. As the pain was ſeated chiefly in the middle of the hypogaſtric region, betwixt the navel and the pubes, therefore a more diligent examination was made in that part, by which the ſurgeon perceived a ſort of undulation, though there was neither hardneſs nor tumour, nor any kind of change in the colour of the integuments. But by long experience, he determined from his knowledge in other diſeaſes of the like nature, that there was here concealed a deep abſceſs which was the cauſe of all the maladies; and though he was oppoſed by four ſurgeons who had attended the unhappy woman before, yet he inſiſted upon making an opening in that part, which with great caution he performed, till he had penetrated into the cavity of the abdomen. But notwithſtanding this opening was made,

[e] Traité complet de Chirurgie. Tom. I. pag. 280.

no

no matter could be discharged even though the abdomen was compressed, the patient held her breath, and the posture of the body was altered. The excellent surgeon being astonished at his ill success, went away privately derided by the other surgeons, and candidly confesses that he did not sleep all the night. The next morning upon removing the apparatus which was applied the day before to the wound, he had the satisfaction to see a large quantity of matter discharged, though he could not understand where it lay concealed. The matter continued to discharge itself daily, for about the space of six weeks, and the woman by that time perfectly recovered of so desperate a disorder. She afterwards bore children, and was able to walk very well, only inclining a little towards the right side, where the disorder had been seated. I remember to have seen a case of the like nature, when a surgeon opened a deep abscess in a woman's breast, which did not discharge so much as one drop of matter, although the scalpel had entered to the depth of above an inch; but yet a few hours after a large quantity of matter discharged itself spontaneously through the opening. From hence it is evident that the diagnosis in such a case ought not easily to be changed immediately; when after maturely considering all the circumstances, it is concluded that the part ought to be perforated or laid open; for although the point of the scalpel should not have penetrated into the cavity of the matter, yet the matter will be afterwards derived towards that part, as there will be there a less resistance.

Avoiding the fibres and vessels.] If the confined matter is lodged immediately under the skin, or if, as Celsus[a] terms it, the matter is conjoined to the skin; it is evident enough that there can be no danger of injuring any considerable fibres or vessels as the matter elevates the skin from the subjacent part; nor has it ever yet appeared that a true suppuration has succeed-

[a] Lib. VII. cap. 2. pag. 409.

ed in the ſubſtance of a muſcle, but that it is always lodged in the panniculus adipoſus, for though Ægineta [e] ſays, *quod abſceſſus ſit corruptio et permutatio carnium aut carnoſarum partium, veluti muſculorum, venarum, arteriarum*; "that an abſceſs is the corruption, or al-"teration of the fleſh or fleſhy parts, as the muſcles, "veins, and arteries;" yet we are taught by daily obſervation, that after the panniculus adipoſus has been conſumed by large ſuppuration, or even gangrenes, yet the muſcles have appeared extremely clean and intire. It is indeed true, that we ſometimes obſerve extraordinary changes, not only in the tunica adipoſa, but alſo in the ſubſtance of the muſcles themſelves; but then upon opening ſuch a tumour there is not a diſcharge of matter, but a liquor of a different kind, whence it would ſeem that thoſe diſorders ought not to be ranked among the claſs of ſuppurations or abſceſſes. A remarkable caſe of this nature is related in the *Medical Eſſays* of *Edinburgh* [f], of a woman who had a tumour for ſome months upon the external part of the leg, more prominent and ſoft in the middle, with a manifeſt fluctuation when it was preſſed by the fingers. As the ſkin of the part looked red, was attended with an acute pain, a hectick fever, night ſweats, and a diarrhœa returning every third day, *etc.* it therefore ſeemed moſt adviſeable to incide or open the part. And therefore after maturating cataplaſms had been applied for two days, and the integuments were much extenuated, ſo that an evident fluctuation might be perceived, an inciſion was then made ſufficiently deep, to the length of an inch and a half; but though the tumour was thus opened, it did not diſcharge a drop of matter, but there flowed out about two or three ounces of mucus. On the day following a fungous maſs appeared, ſprouting up through the opening, which being removed, grew again, and after a large quantity of this ſubſtance had been cut off, upon introducing

[e] Lib. IV. cap. 18. pag. 64.
[f] Medical Eſſays, Tom. I. p. 234.

the

the probe, it passed quite through the substance of the leg, till it touched the skin on the opposite side. A few days afterwards the woman died, and the skin of the affected leg appeared sound, but the panniculus adiposus, together with the muscles, were changed into a fungous mass, so that none of the muscles could be distinguished, even by a diligent examination. The periosteum had here receded on all sides from the bones. From this case it is evident that the muscles may be changed into a shapeless mass by diseases, but yet there was no matter found there, which is very remarkable. Perhaps Hippocrates[z] might intend the same kind of abscess, when he says, *Verum, ut summatim dicam, cætera quoque omnia, quæ mucosa sunt, et mucos producunt, utpote glutinosa, ubi tangantur, subito in hanc vel illam partem sub digitis elabuntur, quam ob rem profundis inveniunt hæc Medici, quam putant.* "But to speak in brief, all other parts which are "mucous or produce a mucus, as being glutinous "when they are touched, they suddenly slip from un- "der the fingers to this or that part, and therefore the "physicians find the matter seated deeper than they "imagined." For in this place he treats of a fracture of the ear, followed with a suppuration; and observes that if the incision ought to be made, it should not be small, because the matter is more deeply seated than any one would imagine; and a little before he observed, that cataplasms applied to the ear, were prejudicial, as they excited abscesses with a great deal of mucus and troublesome suppurations; and then he subjoins the sentence which we have just quoted from him.

There does not therefore seem to be much danger of injuring the fibres in opening a mature abscess, and therefore that caution is needless which is so largely described by Fabricius ab Aquapendente[a], almost in

[z] De Articulis. Charter. Tom. XII. pag. 363.
[a] De Chirurgicis Operat. cap. 107. pag. 654.

every part of the body of which he treats; that is, to make no inciſion but according to the courſe of the ſubjacent muſcular fibres; for even that ſame author confeſſes afterwards in the ſame chapter[i], "that thoſe "who are ignorant of anatomy cannot err in the "opening of an abſceſs, by reaſon of the quantity of "matter which elevates the ſkin, and ſecures the ſub-"jacent parts from the knife."

The abounding matter is afterwards to be gently preſſed out at ſeveral times.] In the larger ſort of abſceſſes, in which there is a very great quantity of matter collected, it does not ſeem to be always ſafe to diſcharge the matter intirely at one and the ſame time. For all the parts which inveſt the abſceſs, were before very much compreſſed by the matter, and if they were freed from the preſſure one moment, they would become very flaccid, and admit a great quantity of blood in their veſſels, ſo that leſs blood would be ſent to the brain and cerebellum, whence a fainting and death itſelf might follow. The ſame danger is alſo at hand, if a part is ſuddenly ſet at liberty from the preſſure which it received from any other collected humour; whence Hippocrates[k] obſerves, "that thoſe expire "who have the water or matter intirely diſcharged, "after the operation of perforating or cauterizing in "an empyema or a dropſy." But if the abſceſs is ſeated in ſuch a part of the body, that the parts may be compreſſed by bandage, in proportion to the quantity of matter diſcharged, then the greateſt evacuations may be ſafely performed at once, as we ſhall declare when we come to treat of the cure of an aſcites by paracenteſis. Nor will it be at all injurious to leave a quantity of matter in the abſceſs, for its cavity being covered as it were with a natural balſam, will be fomented and deterged, the half dead ends of the veſſels will be ſeparated, and the whole better diſpoſed to

[i] Pag. 662.
[k] Aphor. 27. Sect. VI. Charter. Tom. IX. 263.

heal,

heal, as we ſaid more at large in the hiſtory of wounds, § 158. numb. 7, 8, and 9. It is only neceſſary not to let ſo much matter remain as to injure the parts by diſtending them, or ſo as to occaſion it to penetrate into the panniculus adipoſus; both which will be prevented, if the opening is left free, and made in ſuch a part of the tumour, that the redundant matter may flow out by its own weight. Whence great caution is to be uſed that the opened abſceſs,

Be neither moleſted by the admiſſion of the air, nor by the uſe of tents.] After the abſceſs has been opened, even though all its matter was diſcharged, yet more will be collected there again in the ſpace of about four and twenty hours, and ſometimes ſooner, which will alſo require to be diſcharged in the ſame manner. Therefore ſurgeons who were fearful, leſt the lips of the divided abſceſs ſhould unite too ſoon, uſually introduce tents to prevent the orifice from concreting. But ſuch tents formed of dry ſcraped lint, ſwell very much by abſorbing the contiguous humours, by which means, as they are of a conical figure, they are thruſt out in a little time, or elſe if they are retained by the application of plaiſters and bandages, they ſtop up the orifice like a cork, and prevent any diſcharge of the matter, which therefore endeavours to make itſelf new paſſages into the panniculus adipoſus, which is too eaſily dilatable. Beſides, theſe tents gradually lacerate and diſtract the lips of the opening, while they ſwell by abſorbing the humours; from whence a painful tumour and a new inflammation often ariſes. It is therefore evident that tents are in this caſe either uſeleſs or pernicious. But when the apparatus or dreſſings are renewed, and the tent is extracted to diſcharge the matter, there is then a paſſage given to the air into the empty cavity; but how pernicious the air may prove by drying up the extremities of the tender veſſels, which are naturally open, has been ſaid in the commentaries on § 204. and 245.

The beſt method of all therefore will be to keep the opening always covered with a flat pledgit, ſo that the matter may continually flow out with eaſe, taking care alſo that neither the bandages nor plaiſters preſs upon the orifice; but rather make a gentle preſſure upon the circumjacent parts, by an artificial application of compreſſes and bandage; and thus the matter may be derived towards the open orifice, which is free from any manner of preſſure. But the uſe of tents in open abſceſſes ſeems to have been long ago ſuſpected, even by Celſus[1], when he ſays, *Tum, ſi quæ in alis, vel inguinibus ſunt, ſine linamento nutrienda ſunt. In cæteris quoque partibus, ſi ima plaga exigua eſt, ſi mediocris ſuppuratio fuit, ſi non alte penetravit, ſi febris non eſt, ſi valet corpus, æque linamenta ſupervacua ſunt. In reliquis, parce tamen, nec, niſi magna plaga eſt, imponi debent.* "For if any of them are ſeated either "in the arm-pits or groins, they are to be incarned "without lint. Alſo when in other parts the bottom "of the opening is but ſmall, if the ſuppuration was "but moderate or ſuperficial, and not attended with "a fever or diſorder of body, the uſe of lint is even "there unneceſſary. In others lint is to be uſed but "ſparingly, or not at all, unleſs the wound is large." See what has been ſaid concerning the ill effects of tents in the commentary on § 299.

SECT. CCCCXI.

LAſtly, the abſceſs is to be treated with medicines which mundify, ſuppurate, digeſt, heal, deterge, or dry, according to the different nature of the caſe, and agreeable to the doctrine of wounds from § 192, to 220.

We come now to treat of thoſe curative indications which are mentioned in the two laſt numbers of § 402.

[1] Lib. V. cap. 28. pag. 327.

namely

namely in what manner the opened abſceſs is to be cleanſed and reduced to the ſtate of a clean wound. For the whole internal ſurface of the abſceſs has been macerated for ſome time in the confined matter, by which means it is almoſt conſtantly more or leſs diſeaſed, as was ſaid in the commentary on § 402. numb. 5. It will be therefore neceſſary to cleanſe this internal ſurface, and ſeparate all thoſe parts of the ſolids and fluids, which are ſo far corrupted as to impede the union of the other ſound parts. But the ſurface of the abſceſs will be the fouleſt of all, if the matter by being too long confined, has changed its balſamic quality into an acrimony; for then it in a manner conſumes the adjacent parts of the ſkin and panniculus adipoſus: but it would be impoſſible to unite or heal the parts thus foul before they are cleanſed, as hath been very juſtly obſerved by Galen [a], when he ſays, *quum vero cutis in ſuppurationibus amplius extabuerit, ita ut attritis veſtium fragmentis ſimilis reddatur* (ὡς ῥακώδες γενέσθαι) *difficulter ſubjectis corporibus coaleſcit; itaque emiſſario largiore facto ulcus neceſſario curandum eſt.* "But when "the ſkin is ſo much extenuated in large ſuppurations, "that it reſembles the rags of a worn-out garment, "it very difficultly unites with the ſubjacent parts, and "therefore it will be neceſſary to cure the ulcer by en- "larging its opening or diſcharge." But what remedies are required to depurate a ſordid ulcer, and to reduce it to the ſtate of a clean wound, has been declared before, in the hiſtory of wounds, eſpecially in the commentaries on § 204, and the following to 210.

[a] Method. Med. ad Glaucon. Lib. II. cap. 9. Charter. Tom. X. pag. 384.

SECT. CCCCXII.

IF the patient is poſſeſſed with a needleſs fear of the knife, a cauſtick may be applied to the part which points (410), and the eſchar being ſoftened with freſh butter, may be afterwards ſeparated, and the reſt of the treatment conducted as before (at § 410, 411.)

A mature abſceſs may be moſt ſafely opened by the ſcalpel; but ſometimes the ſurgeon is concerned with a patient of ſo puſillanimous a condition, as even to faint away at propoſing the knife; tho' even in theſe caſes, it is beſt to deceive the patient and open the abſceſs by inciſion when it is not ſuſpected. Various machines have been invented by ſurgeons for this purpoſe, as the concealing of a lancet in a ring upon their fore-finger, or elſe a lancet being fixed with its points through a plate of metal, the plate is then covered with ſome cataplaſm or ointment, and being applied to the part, the buſineſs is eaſily performed, by preſſing the point gently over the part to be divided. There are ſeveral other contrivances of this nature to be met with in Parey * and others. But if even by this means the neceſſary opening cannot be made in a mature abſceſs, nothing then remains but to apply a cauſtick, or potential cautery as it is called by the ſurgeons, to the pointing part of the abſceſs: of theſe cauſticks there are ſeveral kinds in the ſhops, ſuch as the lapis infernalis, or the common cauſtick compoſed of quick lime and pot-aſhes, (ſee the *Materia Medica* correſponding to this aphoriſm) which are thoſe chiefly in uſe. Firſt a plaiſter is applied to the part, in which there is a ſmall aperture correſponding to that part of the ſkin to which the cauſtick is to be applied; and to this aperture the cauſtick is then fixed and retained by

* Livre VII. chap. X. pag. 167.

applying

applying another plaiſter over the whole, and thus the apparatus is left on for an hour or two, or till the eſchar is burnt ſufficiently deep. After this the eſchar is ſeparated from the living parts, by dreſſing it with baſilicon, freſh butter, or the like, and then the matter is diſcharged through the aperture as before made, after which the cure may be conducted as where directed. But it is certain that thoſe who are afraid of the knife ſuffer more pain from the cauſtick; for a mature abſceſs is divided by the ſcalpel in a moment, whereas a cauſtick is obliged to lie upon the part an hour or two, or even longer, and after all there is ſtill a conſiderable pain felt when the eſchar is gradually ſeparated from the contiguous living parts; to which add, that a cauſtick uſually produces a greater deformity in the cicatrix.

Of Fistulæ.

SECT. CCCCXIII.

From what has been ſaid, the origin, cauſe, nature, ſituation, and effects of ſinuſes and fiſtulæ may be underſtood (§ 406.)

When we enumerated the ill conſequences from a too long retention of mature matter in an abſceſs § 406. we obſerved that the matter by its weight, motion, and acrimony, might create ſinuſes and fiſtulæ of different kinds in different parts of the body. We are therefore to treat of theſe ſinuſes and fiſtulæ in the following aphoriſms.

But the word ſinus is uſed among phyſicians and ſurgeons, to denote a cavity in the ſoft parts of the body, which have been removed from their contacts with each other, by the matter collected in an abſceſs, afterwards diſcharged either by a natural or artificial opening. For ſuch is the definition of a ſinus given by Galen * in treating of this ſubject, when he

* Commentar. 2. in Lib. Hippocrat. de Medici Officina, textu 27. Charter. Tom. XII. pag. 64.

ſays,

ſays, *Quoad enim pars ita affecta nullam aperturam habet verſus exteriorem ſuperficiem, abſceſſiſſe ipſa quidem dicitur: affectio autem abſceſſus vocatur. At ubi aliqua ex parte aperta eſt, ſic ut excernatur contentus humor, affectio non amplius abſceſſus, ſed ſinus jam appellatur*; "For when the part thus affected has no opening to-"wards the external ſurface of the body, it is then "ſaid to have abſceded, and the diſorder itſelf is "termed an abſceſs: but when there is an aperture "ſo as to diſcharge the contained humour, the diſor-"der is no longer called an abſceſs, but a ſinus." Now it follows from this definition, that a ſinus muſt neceſſarily follow after every abſceſs; but yet it has been cuſtomary only to call it a ſinus when the ſides of the abſceſs which has been opened and freed of its matter, do not unite ſpeedily together, even though they remain contiguous, but continue a long time divided; and therefore there will be a collection of freſh humours made every day in that cavity, which will retard the cure. Hence we find the following definition of a ſinus given us by Galen [b] in another place, *Quum corpora pus excoriat, et continentia a ſubjectis ſeparat ac diducit; deinde eo (pure) quomodocumque evacuato, ſeparata nequeunt priſtinam conſtitutionem recuperare, affectio ſinus appellatur*: "As the matter excoriates the "parts, and ſeparates or diſſolves the containing parts "from thoſe which are ſubjacent; then that matter "being ſome way evacuated, the divided parts can-"not recover their former continuity, and the diſ-"order is termed a ſinus." The like he alſo ſays in another place [c]. For after having taken notice, as we ſaid in the commentary on § 411. that the ſkin is ſo waſted in ſuppuration, as to reſemble the fragments of a worn-out garment, and very difficultly unites with the ſubjacent parts; he then immediately adds in the

[b] Galen. de Tumor. præternatur. cap. 4. Charter. Tom. VII. pag. 316.

[c] Method. Med. ad Glaucon. Lib. II. cap. 10. Charter. Tom. X. pag. 485.

beginning

beginning of the following chapter; *Quum amplius subjectis sinus corporibus cutis coalescere non potest, ejusmodi affectus appellatur.* "As the skin can now no more "unite with the subjacent parts, such a disorder is "called a sinus." Even this same definition of a sinus is given us almost in the words of Galen by Paulus Ægineta [d].

But a fistula differs from a sinus in that it is narrower and generally of a longer standing, having its orifice and internal surface frequently covered with a callus. Hence we have the following definition of a fistula given by Ægineta [e], *fistula sinus est callosus, plerumque ex abscessibus nascens, ducta ab arundineis fistulis translatione appellata.* "A fistula is a callous sinus, "generally arising from an abscess, and deriving its "name from a reed-pipe." And in another place he adds [f], that fistulæ generally arise from abscesses which have not been well cured. But the latin Hippocrates, Celsus [g], having told us in a few words, that fistulæ arise from abscesses and other kinds of ulcers, defines them by saying, *Id nomen est ulceri alto, angusto, calloso*; "this is the name of a deep, nar-"row, and callous ulcer."

Origin.] The rise of sinuses and fistulæ is evident enough from what has been said in the commentaries on § 406. for a phlegmon being changed into an abscess, if its matter is too long confined or discharged, by too narrow or high an opening, so that it cannot easily escape, it gives birth to sinuses and fistulæ.

Cause.] That is, good matter by its weight and bulk making a passage into the cellular membrane which is very easily dilatable; or else the same matter corrupted by stagnating, and rendered so acrimonious as to corrode the adjacent parts.

[d] Lib. IV. cap. 48. pag. 69. versa.
[e] Lib. IV. cap. 49. pag. 70.
[f] Lib. VII. cap. 77. pag. 93. versa.
[g] A. Corn. Cels. Med. Lib. V. cap. 38. n°. 12. pag. 328.

Their

Their nature.] Conſiſting in a preternatural cavity amongſt the ſoft parts, removed from their uſual contacts by a collection of purulent matter, ichor, ſanies, *&c.*

Seat.] This is always in the panniculus adipoſus; nor do I know that it has ever appeared from any credible obſervations, that the proper ſubſtance of the muſcles has been at any time pervaded by fiſtulæ. We obſerved in the commentary to § 374. how largely the panniculus adipoſus is extended, ſo as to involve the whole body, and almoſt every particular part thereof; it being not only continued round the muſcles and tendons, but alſo inſerted betwixt the ſub-diviſions of the muſcles into their leſſer portions, even as far as the eye can trace them. From whence it is evident that ſinuſes and fiſtulæ may often turn and wind in a ſurprizing manner, and often penetrate to a very great depth from their opening, as ſurgeons frequently find and teſtify by many obſervations. A young man aged twenty-two years, was troubled with a moſt acute pain, for above the ſpace of ſix weeks, which invaded the loins, inguen and nates of the right-ſide, obliging the patient to lie night and day upon his back with his knees drawn up, and his feet bent towards the nates. After the beſt remedies had been uſed withour ſucceſs, no change of colour could be obſerved in the ſkin of the painful parts, nor any alteration of their figure; but at the ſide of the vertebræ of the loins, there was a deep undulation to be perceived (like that of matter) betwixt the ſpine of the os ilium, and the laſt of the falſe ribs. This part being deeply inciſed with a ſcalpel to the length of near three inches, diſcharged above ſix pounds of pure matter: and an incredible quantity of matter was alſo diſcharged afterwards in the latter part of the ſame day from the opening, which overflowed the patient's bed, unknown to him, but to the great relief of his pains. When the ſurgeon removed the dreſſings, and preſſed the abdomen, there was again a large quantity of matter diſcharged, and ſtill much more, when the leg and thigh of the ſame ſide

were

were compreſſed, though there was no apparent tumour in thoſe parts. On the following days, when all the matter had been diſcharged as near as poſſible, by compreſſing the thigh and abdomen, there was ſtill a large quantity of matter again expelled by beginning a compreſſure at the foot, and continuing it up to the knee[h]. From this ſurprizing caſe it appears, that good matter, not at all ill conditioned, may, by its weight only, as it ſhould here ſeem, make itſelf paſſages from the loins, down even to the bottom of the foot; inſomuch that though the whole habit of the patient's body was ſo waſted by this large ſuppuration, that one might eaſily ſpan or graſp the top of his thigh with one's hand; yet within five months after the opening made, he was perfectly recovered, and in two months more he entirely regained all that he had loſt, and even ſeemed to be fatter than before he had the diſeaſe.

I ſaw a caſe of the like nature which had not ſo ſucceſsful an event. A ſoft tumour aroſe on the left-ſide, even with the os ilium, and at about the diſtance of two fingers breadth from the ſpina dorſi, in a healthy briſk and middle aged man, without any manifeſt cauſe. The late celebrated Boerhaave being conſulted, ordered the tumour to be divided by a large inciſion with a ſcalpel, but the fearful patient reſiſted immediately upon the firſt touch with the knife, and could not be prevailed upon either by his friends or the threatning events of his diſorder, to ſuffer the inciſion to be made an end of; for there was but a ſlight puncture made, which ſcarce entered the ſkin, ſo that no matter was diſcharged at that time, but yet by the application of emollient cataplaſms for two days to the wounded ſkin, an incredible quantity of matter made its way out. As all the functions of the body appeared in good condition, there was great hopes of a cure, but the plentiful diſcharge of matter continued daily,

[h] De la Motte Traité complet de Chirurgie, Tom. I. pag. 357, &c.

and

and the ſurgeon preſſing the neceſſity of dilating the ſmall opening, the patient after delaying many days, at length conſented, but did again prevent it from being enlarged as much as it ought, by the reſiſtance he made upon feeling the pain, for he would not ſuffer himſelf to be held by any aſſiſtance. In the mean time the quantity of matter ſeemed to diminiſh for ſome days, but again after a while an exceeding large quantity of matter vented itſelf unexpectedly, almoſt like a torrent. The ſurgeon with much difficulty obtained leave of the patient to examine which way the ſinus tended by his probe, which he could eaſily paſs upwards under the integuments to the ribs; and as the miſerable patient obſtinately perſiſted rather in ſuffering death, than to admit of an eaſy inciſion, therefore a new opening was made by the application of the common cauſtick to that part, where the end of the probe met with a reſiſtance. But though all proper treatment was given with compreſſes, bandages, a convenient poſture of the body, &c. it was yet to no purpoſe, for the matter continued diſcharging in ſuch quantities as to daily overflow the compreſſes, bandages, and even the bed itſelf. In the mean time the patient's body was waſted with a hectick fever, his appetite in the mean time remaining entire, and his bowels neither too much conſtipated, nor too looſe. His body being at length totally emaciated, after ſome weeks time, a tumour appeared in the right inguen as high as the top of the os pubis, by opening which, ſeven pounds of clean matter were diſcharged; and yet there was alſo a continual diſcharge of matter from that aperture in the groin, as well as from the two others in the back, which at length ſo much exhauſted the patient that he quietly expired, even though his appetite remained good to the laſt.

As I very much wondered from whence ſo large a quantity of matter proceeded, and could not imagine that it came from the cavity of the abdomen, through the aperture in the groin, which was the opinion of the

the ſurgeon, though there was no apparent tumour of the abdomen, nor any defect in the chylificative organs throughout the whole courſe of the diſeaſe; I obtained leave therefore of the patient's friends to examine the body.

We introduced a probe through the two openings in the back, nor could we make it to paſs any conſiderable length: but when we entered the probe into the opening which had been made in the groin, it paſſed its whole length without uſing any force. After drawing out the probe, we introduced a leaden plummet through the ſame orifice, and paſſed it gently upwards till it met with a reſiſtance, and then by laying open the tract of the probe by inciſion, we found that it paſſed not into the cavity of the abdomen, but that it went up backward above the pſoas muſcle, under the peritonæum and right kidney; nor could we find any communication betwixt this ſinus and the two openings which were made in the back. In the cavities of the thorax and abdomen, there was not ſo much as a ſingle drop of water to be found; and as we had not obſerved any diſturbance in the functions of the brain, during the whole courſe of the diſeaſe, we therefore refrained from opening the cranium. From hence it is ſufficiently evident, that all this matter was lodged in the panniculus adipoſus only, ſince none of the other parts appeared viciated, and there were no apparent ſigns of a ſuppuration preceding, nor of any matter contained in the larger cavities of the body.

The effects of ſinuſes and fiſtulæ are like thoſe, which we enumerated in the commentary on § 406. reſulting from too long a confinement of matter in a mature abſceſs: For the matter being retained in ſinuſes and fiſtulæ, from whence it can hardly ever be intirely diſcharged, it is there attenuated and putrified by ſtanding, ſo as to degenerate into an acrid ſanies, and this ſooner than in a cloſe abſceſs, becauſe there is here an acceſs given to the air. The ſides therefore of ſinuſes and fiſtulæ will be much injured by this corrupt matter, which

which will ſo much alter them, that it will be afterwards very difficult to cleanſe and reduce them to the ſtate of a pure wound, which yet is abſolutely neceſſary to procure an union of the divided parts; and the matter there reſiding, will alſo prevent the union of the parts, by interpoſing like a foreign body. It is alſo from hence apparent, that fiſtulæ muſt be the worſe conditioned as they are of longer ſtanding, and as they approach nearer to ſome parts, by an eroſion of which we may juſtly foreſee much danger, or ſlowneſs and difficulty, in the cure. Hence Hippocrates[1] treating of this ſubject, ſays, *Fiſtulæ difficillimæ ſunt, quæ id cartilaginoſis et carne vacuis locis fiunt, cavæ ſunt, cuniculos agunt, et ichore ſemper manant. Caruncula autem in eorum oſculo eſt. Facilius autem curantur, quæ in mollibus, carnoſis, et nervorum expertibus locis contingunt.* "Thoſe fiſtula's are very ſtubborn, which "are ſeated in parts cartilaginous and deſtitute of "fleſh; as are thoſe alſo which are cavernous, and "burrow into the parts, continually diſcharging an "ichor. But there is generally a caruncle in the "mouth of thoſe fiſtula's. But thoſe are more eaſily "cured, which are ſeated in ſoft fleſhy parts deſtitute "of nerves." A very accurate but ſomewhat fuller prognoſis of a fiſtula is given us by Celſus[k], when he ſays, *Expedita curatio eſt in fiſtula ſimplici, recenti, intra carnem. Adjuvatque ipſum corpus, ſi juvenile, ſi firmum eſt. Inimica contraria his ſunt: itemque, ſi fiſtula os, vel cartilaginem, vel nervum, vel muſculos læſit; ſi articulum occupavit; ſi vel ad veſicam, vel ad pulmonem, vel ad vulvam, vel ad grandes venas arteriaſve, vel ad maxillas, guttur, ſtomachum, thoracem penetravit. Ad inteſtina quoque eam tendere, ſemper periculoſum, ſæpe peſtiferum eſt. Quibus multum mali accedit, ſi corpus vel ægrum, vel ſenile, vel mali habitus eſt.* "The "cure is ſhort in a ſimple fiſtula which is recent, and "ſeated in the fleſh. The cure will be alſo aſſiſted

[1] Coac. Prænot. n°. 511. Charter. Tom. VIII. pag. 882.
[k] Lib. V. cap. 28. n°. 12. pag. 328, 329.

"by

" by the body itſelf, if that is ſtrong and young.
" But the contrary of thoſe oppoſe the cure, which
" will be alſo difficult if the fiſtula has injured a bone,
" cartilage, nerve, tendon, or muſcle, as alſo if it
" is ſeated in a joint, or if it has penetrated to the
" bladder, lungs, womb, large arteries, or veins, or
" into the fauces, throat, ſtomach, or thorax. It is
" alſo conſtantly dangerous, and even frequently fa-
" tal, for a fiſtula to tend to the inteſtines. Fiſtulas
" are alſo rendered much more malignant, when the
" body is indiſpoſed by diſeaſe, old age, or a bad
" habit."

SECT. CCCCXIV.

AN opened ſinus (413.) may be eaſily diſcovered; but a cavity which is as yet cloſed, is diſcovered by the ſoftneſs to the touch.

We come now to enquire by what ſigns one may diſcover a preſent ſinus or fiſtula; but theſe are ſufficiently evident, when they open outwards in ſome external part of the body. For if a large quantity of matter is diſcharged from ſuch a ſmall opening, or may be forced out from thence by preſſure, it is from thence evident that there muſt be a large cavity for containing that matter. But to diſcover which way the ſinus tends, Celſus[a] orders an examination to be made with a probe, where he ſays, *Ante omnia autem demitti ſpecillum in fiſtulam convenit, ut quo tendat, et quam alte perveniat, ſcire poſſimus, etc.* " But firſt of
" all it will be proper to probe the fiſtula, that we
" may know to what part, and how deep it pene-
" trates," *etc.* And by the ſame method he would alſo have it diſtinguiſhed whether or no the fiſtula has penetrated to the bone, as alſo whether the bone itſelf is carious. But in order to be aſſured whether a fiſtula, opening with but one orifice externally, divides itſelf afterwards into ſeveral branches or

[a] Ibid. pag. 329.

ſinuſes within, he directs [b] the following method to be taken: *Corporis inclinatio docet, num in plures partes fiſtulæ penetrarint; qui ſæpe, cum quis aliter decubuit, aliterque membrum collocavit, pus ferri, quod jam deſierat, iterum incipit; teſtaturque, non ſolum alium ſinum eſſe, ex quo deſcendat, ſed etiam in aliam corporis partem eum tendere.* "An inclination of the body "will demonſtrate whether or no a fiſtula penetrates "into more parts than one; becauſe frequently when "a patient lies in a different poſture, or places the "limb in a different manner, the matter which then "ceaſed to diſcharge itſelf will again flow out, and "not only teſtify that there is another ſinus from "whence it deſcended, but alſo that the ſinus tends "into another part of the body." But the beſt of all methods for diſcovering the capacity and different courſe of ſinuſes and fiſtulæ ſeems to be by a prudent and gentle injection of warm water with a ſyringe. For the water will eaſily inſinuate into all the meanders of a fiſtula, which if it tends outwards under the integuments, will demonſtrate its different courſe by elevating the ſkin into a tumour: but if the ſinus or fiſtula deſcends deep, the quantity of water injected will then only demonſtrate the magnitude or capacity of ſuch a preternatural cavity; nor can much more be diſcovered by the uſe of a probe, which if rudely thruſt through the orifice of a fiſtula, often runs into and lacerates, the panniculus adipoſus, ſo as to make ſinuſes which were not before; nor is it poſſible to diſcover the length of a fiſtula by this means, when in a turning or winding courſe.

But when a ſinus is as yet cloſed, the diagnoſis of it is ſtill more difficult, eſpecially if its ſituation is very deep: but ſome light may be had from the ſigns of inflammation preceding, and the marks of a ſuppuration following; and if after theſe a ſoftneſs and fluctuation is perceived by the touch, we may be cer-

[b] Ibid. pag. 330.

tain

tain enough that there is a ſinus. Add to this, that a ſuppuration of any moment ſeldom lies long concealed in any part of the body without producing a hectic fever. But great prudence is required in determining this matter, to avoid miſtaking a latent aneuriſm or a varix for a deep ſuppuration, which has ſometimes happened; but a ſkilful ſurgeon cannot eaſily run into ſuch an error, if he firſt carefully conſiders the origin and progreſs of the diſorder. It muſt however be confeſſed, that abſceſſes have been ſometimes obſerved ſo latent or deeply ſituated, as to occaſion the moſt ſkilful ſurgeon to be ſometimes in a doubt, as is evident from the extraordinary caſe mentioned in the commentary on § 410. from the excellent ſurgeon Le Motte, who has candidly deſcribed the caſe, with many others of the like nature.

SECT. CCCCXV.

Fiſtulas are cured by opening them in their lower part, by filling their cavities with melted digeſtives, choſe according to the nature of the caſe, by the injection of deterſives, and by bandage gradually preſſing from the bottom upwards, or towards the opening: but the integuments are ſooneſt divided upon a director or grooved camula, or by a ſilver wire, or laſtly by the ſyringotomus.

The cure of all ſinuſes and fiſtulas, requires in general the following. 1. To procure a free paſſage to the matter, and to prevent it from ſtanding long ſo as to corrupt in the ſinus or fiſtula. 2. To cleanſe or deterge the internal ſurface of the cavity of the ſinus or fiſtula, and reduce it to the ſtate of a clean wound. 3. To bring the ſeparated parts now clean into contact, and retain them ſo as they may grow to each other. Now when the two firſt requiſites are performed, the

third may be eaſily obtained, as Celſus [c] very well obſeves, when he ſays, *Neque verendum eſt, ne purum corpus puro corpori junctum non coëat, adjectis quoque medicamentis ad id efficacibus; cum ſæpe exulceratio digitorum, niſi magna cura proſpeximus, ſaneſcendo in unum eos jungat.* "Nor is it to be feared that one clean part "being joined to another, will not concrete if medi- "cines are alſo uſed which are efficacious for that "purpoſe; for we ſee that in ulcerations of the "fingers, if we do not take great care in their cure, "they are joined into one." The principal difficulty therefore conſiſts in procuring a free exit to the confined matter, and in depurating the cavity of the ſinus; for there are many caſes in which this laſt is very difficult, and ſometimes even impoſſible to attain. Thus I ſaw a fiſtula with a narrow orifice opening in the anterior part of the left breaſt, which deſcended by a winding paſſage behind the cartilage of the rib; nor was it poſſible, by any art, to prevent the matter from ſtagnating in the bottom of this fiſtula, ſince the cartilage of the rib made a compreſſion impracticable, and an opening of the fiſtula dangerous, if not impoſſible. Celſus [d] indeed would have a part of the rib cut out in ſuch a caſe, that no corrupt matter may be left behind; but I believe no one will readily cut out a portion of the rib in a living perſon, and afterwards pull it off from the pleura to which it firmly adheres. The patient now mentioned, had undergone all methods that could be tried, but without ſucceſs, and was deſtroyed by the diſorder which was unavoidable, dying in about two years after. Thus alſo when a fiſtula has extended to the bone, and infected the ſame, the parts cannot be depurated before that portion of the bone is exfoliated naturally, or elſe removed by art. Such fiſtulas very often occur about the jaws, which often continue years, and give way to no re-

[c] Ibid. pag. 332.
[d] Lib. VII. cap. 4. n°. 2. pag. 412.

medies;

medies; but after a tooth has been drawn, even a sound as well as a carious one, which by coming thro' the socket of the jaws, continually injured and irritated the adjacent soft parts, they are then often cured in a few days time. But for the cure of fistulæ the following methods are principally recommended.

To open them in their lower part by incision.] If the orifice of the sinus or fistula is so placed that the humours contained in its cavity cannot discharge themselves by their own weight, the cure is always difficult; for they will be accumulated and increase the preternatural cavity. Therefore skilful surgeons always endeavour to make a new opening in the lower part of the sinus, that the matter, sanies, *etc.* may discharge themselves spontaneously. But if they are doubtful in what part the bottom of the sinus or fistula is seated, they stop up the orifice with a tent for the space of twenty-four hours, in such a manner, that nothing can be discharged; and thus, by confining humours, they make a tumour in the most depending part. The same thing is also performed by a prudent injection of warm water. By this method indeed the collecting humours are prevented from stagnating in the cavity of the sinus or fistula, but then the whole internal surface very often remains foul, sordid, or even callous, which therefore makes a depuration necessary.

By filling the cavity with liquefied digestives chose according to the nature of the case.] In what manner sordes of the like nature formed in wounds, are to be removed, has been said in the commentaries on § 207. and the same remedies will be here proper either of a milder or more acrid nature, according as the sordid parts are thicker, or the internal surface of the sinus or fistula more or less callous. Now in an open wound it is very easy to apply these remedies to every point of their surface, but not so in a winding fistula. The antient physicians used collyria for this purpose, by which name we are to understand a sort of cone or tent; for notwithstanding that term is at present generally used to denote

thoſe remedies of the ſhops, which ſerve for the cure of diſeaſes in the eyes, yet it was uſed in a more ample ſenſe among the antients, for Gorræus[d] proves from the beſt authors, that κολλύριον is as much as to ſay a tail cut off (κολοβίωμα). Thus Celſus[e] alſo recommends a plaiſter for the cure of ſimple and recent fiſtulas in the fleſh, which was applied for recent wounds, provided it contains ſome ſalt, allom, verdigreaſe, or ruſt of braſs, *etc.* And he then adds: *Exque eo collyrium fieri debet altera parte tenuius, altera paulo plenius. Idque ea parte, qua tenuius eſt, antecedente demitti opportet in fiſtulam, donec purus ſanguis ſe oſtendat, etc.* "And of "this a collyrium ought to be formed ſmall at one "end, and a little larger at the other: and this is to be "introduced into the fiſtula with the ſmalleſt end fore-"moſt till clean blood ſhews itſelf," *etc.* The whole intention ſeems to have been by this method to apply ſuch medicines to every point of the internal ſurface of the ſinus or fiſtula, as might ſeparate the ſordes, or conſume the callus there ſeated. The beſt method ſeems therefore to be not barely to add the aloes, myrrh, olibanum, verdigreaſe, *etc.* to the ſubſtance of a fat plaiſter, but rather to mix them with honey or the yolk of an egg; for then they may be diſſolved by the affluent humours, and act with more power on the parts to which they are applied; and as they are thus reduced to a fluid ſtate, they will be more equally diſtributed throughout the whole extent of the ſinus or fiſtula. Add to this, as collyria are required to have a ſolid form to convey them through the orifice to the bottom of the fiſtula, therefore if they do not gradually diſſolve or melt, they will contuſe or preſs the adjacent ſoft parts, like a foreign body, and by that means do more harm than good. For this purpoſe therefore let ſome balſam, for example, turpentine, be taken and mixt with an equal quantity of the yolk of an egg, and to theſe well incorporated add honey and other detergents according as the caſe may require; and of theſe let a

[d] Definit. Med. pag. 324, 325. [e] Lib. V. cap. 28. pag. 330.

hollow

hollow cone be formed of a ſolid conſiſtence like the ancient collyria, or rather a more fluid form of medicine, which melting with a gentle heat may fill up the whole cavity.

By the injection of deterſives.] It is very evident that the preceding method can take place only where the ſinus or fiſtula is ſimple and runs in a ſtrait courſe; but when the fiſtula takes a winding courſe, or as it were, divides into ſeveral branches, there is then occaſion for other means. For then we ought not to uſe collyria: as Celſus tell us[f], *Quod unam partem curet, reliqua omittat; ſed eadem medicamenta arida in calamum ſcriptorium conjicienda ſunt, iſque ori fiſtulæ aptandus; inſpirandumque, ut ea medicamenta intus compellantur. Aut eadem ex vino liquanda ſunt, vel, ſi ſordidior fiſtula eſt, ex mulſo; ſi calloſior, ex aceto; atque intus infundendum, quidquid inditum eſt.* "Which cure only one "part, and omit the reſt; but we are alſo to throw in "dry medicines through a writing quill, adapted to "the mouth of the fiſtula, blowing through the quill "to drive in the medicines. Or elſe the ſame medi- "cines are to be diſſolved in wine, or in mead if the "fiſtula is fouler than uſual: but in vinegar if it is "more callous, and the things thus prepared, are to "be injected or poured into the cavity." All thoſe remedies therefore which ſerve occaſionally for the preparing of collyria being diluted in ſome convenient liquor, are uſually injected through the mouth of the fiſtula; and of this nature there are various forms of remedies to be found in the *Materia Medica* correſponding to this aphoriſm. But it muſt be obſerved, that theſe injections are often prejudicial, if they are urged in too violently; for then they may eaſily make new paſſages into the panniculus adipoſus, and by that means increaſe the diſorder; and beſides this, they are all ſerviceable only inaſmuch as they remove the ſordes, and conſume the calloſity of a fiſtula; but after the

[f] Ibidem, pag. 332.

parts have been once depurated, they will be rather injurious by preventing their union; for even the beſt balſams interpoſed betwixt wounded or divided parts, do like foreign bodies prevent them from healing and uniting. Therefore Celſus [h] adviſes us to uſe agglutinating medicines only. *Si ea tunica, quæ inter foramen et integram carnem eſt, vecta tot medicamentis exeat, infraque ulcus purum ſit:* "When that coat or ſkin "which is ſeated betwixt the opening and the ſound "fleſh, is ſeparated and diſcharged by the many re-"medies, and leaves the ulcer clean underneath." For then he orders the application of a ſpunge dipped in boiled honey, and condemns the collyria; ſince there can be no danger of one clean part conjoining with another, as we obſerved a little before from the ſame author. But the whole internal ſurface may be known to be clean, if it diſcharges a white, ſmooth, and uniform matter without any ſanies or ichor, and without any fœtid ſmell. Thus for example, a tent or collyrium being introduced into a ſinus or fiſtula, as alſo the plaiſter or pledget covering its orifice, is diligently examined by the ſkilful ſurgeon when he renews the dreſſings, in order to perceive whether they are moiſtened in any part with a thin ſanies inſtead of laudable matter; for then they are aſſured that all the compaſs of the ſinus or fiſtula is not yet depurated.

By bandage preſſing gradually from the bottom towards the opening.] The beſt matter corrupts by ſtagnating, and degenerates into a thin and acrid ſanies, ſee the commentary on § 402. numb. 4. ſo that although the internal ſurface of the ſinus or fiſtula has been well cleanſed, new ſordes will be again formed, unleſs the ſtagnation and corruption of the matter can be prevented. But in order to effect this, an artificial compreſſure by bandage is of the greateſt efficacy, joined with ſuch a poſture of the part, as that the collected matter may paſs freely out through the orifice of the fiſtula, and not at all ſtagnate or be collected in its bottom. Thus we read in Galen [i], that a ſinus

[h] Ibidem. [i] Ibidem.

which

which descended through the thigh, and terminated at the knee, whose original orifice opened above the middle of the thigh, was cured, without making any counter opening, by fixing soft compresses or pillows under the ham, so as to raise it higher than the inguen. But the bandage ought to be such as by a gentle pressure may retain the clean parts in contact. Now as even in a clean wound of any moment, there is matter daily formed, it ought to be capable of a discharge; and therefore the sinus is not to be compressed by compresses and bandage all at once throughout its whole length, but by proceeding gradually from the bottom to its opening. Therefore the fundus or lowest part of the sinus is to be diligently sought for: but this may be discovered by a prudent injection of mead, or the like deterging liquor, serving to depurate fistulas, if attention is at the same time given, how far and towards what part the liquor tends, which may be also known by beginning a gentle pressure upon the parts below, and continuing the same upwards so as to expel the matter contained in the sinus; for when the pressure made upon the adjacent parts has extended to the bottom of the sinus, the matter will then begin to flow out through its orifice. The part being thus discovered, in which the bottom of the sinus or fistula is seated, if the surgeon is assured that the whole internal surface of it is clean, he then applies a compress to that part, by which means it determines the pressure by his bandage, so as to reduce the clean parts at the bottom of the fistula into contact; the remainder of the sinus or fistula being only retained loosely with a spiral bandage, while the orifice remains open, to allow of a free discharge to the contained matter. Galen [h] has very well described this method, in treating of the various methods of curing sinuses, where he says: *Colligatio autem a fundo sinus quidem incipiat, finiatur autem in ejus orificio. Fasciarum vero circumductiones sine dolore fundum sinus premant, quæ paulatim*

[h] Method. Med. ad Glaucon. Lib. II. cap. 10. Charter. Tom. X. pag. 386.

usque

uſque ad orificium (ſinus) laxentur: "But the bandage is to begin at the bottom of the ſinus, and terminate at the orifice; but the circumvolutions of the bandage are to preſs ſo gently upon the bottom of the ſinus, as not to give any pain, and are to be laid on more looſely by degrees, till they come to its orifice." He alſo obſerves that a plaiſter ought to be applied to the orifice, with an aperture cut in it by a pair of ſciſſars, to give a diſcharge to the matter when there is any, *etc.* At the following dreſſings all the matter is to be gently preſſed out before the compreſs is removed from the bottom of the ſinus, to which it was applied, and after removing the compreſs, an attempt muſt be made to expreſs what other matter is lodged in the adjacent parts; and if any quantity of matter is then diſcharged, it is a ſign that the compreſs was not applied low enough, but that matter is as yet contained beneath it, and therefore it will be proper to alter its ſituation; but if no matter is then found to diſcharge itſelf, the compreſs is to be applied a little higher up towards the mouth of the ſinus, aſcending a little at each dreſſing, and with the like precautions; by which means a concretion of the ſeparated parts will begin in the bottom of the ſinus, and proceed gradually towards its orifice. Hippocrates [k] expreſſes this matter with his uſual brevity when he ſays, *Quæ abſceſſerunt, ut ſublimia ſint, naturalem ſedem tangere quidem debent, non vero comprimi:* "For thoſe parts to fill up which have been waſted, they ought to touch each other without being compreſſed," (for that this is the ſenſe of this obſcure paſſage, appears from the commentaries of Galen to this text.) "This contact is to begin in the ſound parts, and terminate at the opening of the ſinus, that what matter is confined may be depreſſed or milked out, and no more be collected." But the term milked out ſeems to be here very proper

[k] Hippocrat. de Medici Officina, Textu 27. Charter. Tom. XII. pag. 63.

to

to expreſs a gradual derivation of the matter from the bottom of the ſinus towards its opening made by a gentle preſſure in the ſame manner as the milk is forced out by a gentle preſſure continued from above downwards in the milking of a cow, while the orifices of the teats remain open. But the ſigns by which we know that the cure in this caſe ſucceeds, are very well enumerated by Galen [1] as follows; *An vero ſinus profundum pulchre conglutinatum fuerit, hæc tibi ſit diagnoſis ex ſanie effluente: ſi pauca vel multa ſit, cocta vel cruda. Præterea ſi circa ipſum ſinum neque dolor ſentiatur, neque tumor appareat, ſed totus locus æquabilis ſit, ſiccus, ac doloris expers. Quod ſi puris probe cocti pauculum in orificio, videris, multo magis de glutinando ſinu ſperandum eſt.* "But whether or no the bottom of the ſinus is well "conjoined, take your diagnoſis from the effluent "matter: according as that is either in a large or "ſmall quantity, and crude or concocted. As alſo "when there is no pain felt about the ſinus itſelf, nor "any tumour appears, but the whole part ſeems even, "dry and without pain. But if you ſhould ſee only "a ſmall quantity of pure concocted matter in the "orifice, there is ſtill more reaſon to hope for the "agglutination of the ſinus." But though this method may ſucceed very well in many inſtances, yet it is evident enough that it cannot take place, unleſs the whole ſurface of the ſinus or fiſtula is very clean, and acted upon by an external preſſure. Therefore when a fiſtula ariſes from an injury of the ſubjacent bone, or has not been firſt well depurated of its calloſity, or if it runs in ſuch a manner that an external preſſure cannot reach to its bottom, the only method that then remains, is to lay open the integuments by inciſion, that ſuitable medicines may be applied to the whole ſurface of the fiſtula.

[1] Galen. Method. Med. ad Glaucon. Lib. II. cap. 10. Charter. Tom. X. pag. 386.

But

But the integuments are the ſooneſt divided by inciſion upon a grooved probe or director.] The moſt expeditious method of curing a fiſtula or ſinus, is to convert it into an open ulcer, by dividing the integuments; for the difficulty of the cure does not ariſe ſo much from the internal calloſity, as from the matter which there ſtagnates and corrupts. It appears from the moſt faithful obſervations, and from many caſes of this nature, which I myſelf have ſeen, that fiſtulæ have been cured within the ſpace of fourteen days, barely by inciſion, when other methods have been tried in vain for many months, or even years. Celſus [m] being well acquainted with this matter, therefore pronounces, *Adverſus fiſtulas quoque, ſi altius penetrant, ut ad ultima demitti collyrium non poſſit, ſi tortuoſæ ſunt, ſi multiplices, majus in manu, quam in medicamentis præſidium eſt; minuſque operæ eſt, ſi ſub cute tranſverſæ feruntur, quam ſi recta intus tendunt. Igitur, ſi ſub cute tranſverſa fiſtula eſt, demitti ſpecillum debet, ſupraque id ea incidi. Si flexus reperiuntur, hi quoque ſimul ſpecilla et ferro perſequendi ſunt. Idemque faciendum, ſi plures ſe quaſi rivuli oſtendunt.* "But for the cure of thoſe "fiſtulæ which penetrate ſo very deep, or run ſo winding, or branched out, that a collyrium cannot be "conveyed to the bottom, the cure is then to be rather "expected from manual operation than the uſe of medicines; and the cure will be ſtill more expeditious "by the operation, if the fiſtula runs tranſverſely under the ſkin, than if it tends directly inwards. "Therefore in a tranverſe ſubcutaneous fiſtula, a probe "or director is to be introduced, upon which it is to "be laid open by inciſion. If any turnings are found "in the fiſtula, theſe are alſo to be followed and laid "open by the knife or director. The ſame is to be "alſo done, when the fiſtula appears to divide itſelf as "it were into ſeveral branches." There are indeed many boaſted remedies or arcana for the cure of ſtubborn

[m] Lib. VII. cap. 4. n°. 1. pag. 412.

fiſtulæ

fiſtulæ without cutting, but how little we ought to confide in them, appears from the inſtance of the late French king, Lewis XIV. who being diſordered with a fiſtula in ano, had an infinite number of remedies propoſed to him, the principal of which were made trial of by the king's order, upon patients afflicted with the ſame diſeaſe, but all without effect: and though a whole year was ſpent in theſe trials, the king at length ſubmitted to, and reſolutely underwent, the operation, even though the ſurgeon [a] was obliged to lay open all the branches of the fiſtula by many inciſions. But that this inciſion may be ſafely performed without injuring the adjacent parts, ſurgeons have contrived various methods. For when the fiſtula runs immediately under the integuments, it may be then ſufficient to introduce a director carefully through the orifice of the fiſtula down to its bottom; and then to make an inciſion by guiding the knife or razor along the groove of the director, ſo as to cut through all the parts which are intercepted betwixt them. But when the courſe of a fiſtula tends more inwards, as it very frequently does when ſeated in the anus, in that caſe it is cuſtomary ſometimes to uſe

A ſilver wire.] Formed of the pureſt ſilver heated red hot, and ſuffered gradually to cool, to render it the more pliable, and being alſo furniſhed with an obtuſe end like a probe, which is conveyed through the opening of the fiſtula, entering it by degrees till it has reached the bottom, and one may perceive the obtuſe end under the integuments: then an inciſion being made in that part, the wire is drawn through, and the two ends of it are then drawn up, ſo as to remove the integuments from the ſubjacent parts, that they may be ſafely divided either by the ſcalpel or ſciſſors.

This was the method formerly uſed for the curing of fiſtulæ in the anus by inciſion; for they introduced

[a] Dionis Cours d'Operations de Chirurgie, Demonſtrat. 4to. p. 228, &c.

ſuch

ſuch a probe through the external orifice of the fiſtula, until the ſurgeon could perceive the extremity of it coming into the anus, by introducing his forefinger up to the internal orifice of the fiſtula; or if there was no entring an orifice, they boldly perforated the inteſtine with the end of the probe. They then bent the end of the probe with their forefinger, and brought it out through the anus, ſo that by pulling the two ends of the wire, they extended the parts which were to be divided, that is not only the common integuments, but alſo of the ſphincter ani, and part of the inteſtinum rectum were to be divided in this caſe[o]. Hippocrates[p] has ſtill another method of curing fiſtulæ of the anus: He orders a probe of tin, the eye of which is to be armed with five threads, circumvolved and tied together with a horſe-hair, which is to be conveyed through the orifice of the fiſtula; then the forefinger of the left-hand being introduced into the anus, the end of the probe is to be bent and brought outward, until the thread follows. After the probe is extracted, he orders the two ends of the ligature to be tied in a knot, and the patient to be then diſmiſſed, that he may go about his affairs like other people who are well. His intention is ſo to extenuate all the integuments by degrees with a ligature, that they may be at length quite cut through: whence Hippocrates obſerves, that the ligature is to be tightned every day by twiſting in proportion as it becomes looſer, by cutting through the fiſtula; and if the ligature ſhould ſeem to be corrupted, a freſh one is to be introduced by tying it to the end of the former, which is to be then extracted, and the new ligature tightned as before. Celſus[q] very juſtly calls this a very tedious method of cure; but whether it is without pain, as he alſo aſſerts, I very much doubt: For he ſays, *Paulatim cutem, quæ ſupra fiſtulam eſt, incidit, ſimulque et id ſaneſcit, quod a lino relictum eſt, et id,*

[o] Ibid. pag. 285. [p] De Fiſtulis, cap. 3. Charter. Tom. XII. pag. 142. [q] Lib. VII. cap. 5. n°. 4. pag. 414.

quod

quod ab eo mordetur, inciditur. "That the ligature "gradually divides the skin which is above the fistula, "while in the mean time those parts heal, which have "been left behind the ligature, and those are divided "which are thereby constringed." For when by the motion of these parts in walking, the ligature is rubbed against the sides of the fistula, it must give no small uneasiness; but if the sides of the fistula are so callous as not to receive any pain from that attrition, then that method will not easily divide the integuments, but after a tedious delay recourse must be had to the knife itself. But that the preceding method had been often used without success, is evident from what follows a little after in the same place of Hippocrates[r]. For he says: *Si vero fistula non fuerit exesa, demittens specillum incide, quo usque illud pervenerit, et insperge æris florem, et per quinque dies relinque, etc.* "But "if the fistula should not be thus cut through, in-"troduce a probe and lay it open as far as it penetrates "by incision, after which make an aspersion of flores "æris, and thus leave it for five days," *etc.* Celsus observes in the place lately cited, that those who are in haste to have the integuments divided, ought to tighten the ligature: and he likewise observes, that the same division will be hastened by spreading the ligature with medicines which corrode callous parts, but then the pain will be greater; and at last he adds, that it may be also done by the scalpel, the use of which will perhaps be necessary after all, *etc.* He seems therefore to undervalue this method by ligature, as it makes no discharge or separation of the foul parts, and often occasions much pain and uneasiness to the patient, as well as trouble to the surgeon.

Syringotomus.] This instrument is so called from its use in cutting fistulæ, and there are various forms of it described by authors. It is most commonly recommended for the cure of fistulæ of the anus. The

[r] De Fistulis, cap. 4. pag. 143.

instrument

inſtrument is compoſed of a probe joined to a ſcalpel or razor, ſo that by introducing the former through the fiſtula, a diviſion is then made by the latter, and thus one inſtrument performs what was to be done by two. But the ſyringotomi which are repreſented to us by Scultetus, Van Solingen, Fabricius ab Aquapendente, and others, ſeem to be leſs commodious for this purpoſe, and eſpecially for dividing fiſtulæ of the anus. For here a falciform knife terminates in a probe made of the ſame metal, ſo that this laſt part of the inſtrument has not the pliability which is required to bend the probe by the finger in the cavity of the inteſtine, ſo as to draw it outwards. But the induſtry of modern ſurgeons has corrected the defects of this inſtrument[s], for they unite a probe of pure flexible ſilver to a crooked knife made of the beſt ſteel, while part of the inſtrument is concealed in a crooked handle; but it may be ſeen repreſented by a figure in the end of this book.

The fiſtula being thus divided, is changed into an open ulcer; and if then it appears to have many branches, each of them are to be divided after the like manner, that there may be no lurking places for the matter to conceal itſelf in, ſo as to ſtagnate and corrupt. But as the internal ſurface of the fiſtula is in this caſe frequently found callous, therefore ſurgeons uſually make ſcarifications in ſeveral places, that the calloſity may be the ſooner removed by the application of digeſtives or corroſives. Even Celſus[t] would have the whole callus to be cut out, after the fiſtula has been laid open to its bottom. But every thing which has been ſaid in the commentary on § 411. is alſo to be obſerved in this place.

[s] Garengeot. Traité des Inſtrumens de Chirurgie, Tom. I. cap. IX. pag. 286.

[t] Lib. VII. cap. 4. pag. 412.

SECT.

SECT. CCCCXVI.

FROM what has been ſaid, we may derive a knowledge of the nature, conſequences, and methods of treating buboes, parotides, furuncles, or boils, anthraces, carbuncles, phymata, eryſipelata, the meaſles, ſmall-pox, purple ſpots, and the like.

From all that has been hitherto ſaid in the hiſtory of inflammation, and ſuppuration thence following, we may derive a knowledge of a great many diſorders, which may be referred to inflammation, and its conſequence as the cauſe, notwithſtanding they are diſtinguiſhed by peculiar names in common practice. And at the ſame time alſo we may be able to deduce their prognoſis and method of treatment from the ſame knowledge. The principal of theſe diſorders are thoſe here enumerated, ſuch as

Buboes.] The Greek phyſicians denominate the groins (βουβῶνες) *bubones*, and they likewiſe denominated the glands there ſeated, by the ſame name; nor did they alter the name, even when the like tumour was obſerved in the glands of the axilla. We even read in Galen[a] of tumours formed in other glandular parts of the body, called by the ſame name: for he ſays, *Quinetiam in collo et ſecus aures ſæpe glandulæ intumeſcunt, natâ ulceribus circa caput, collum, vel aliquam ex vicinis partibus. Nominant autem ſic intumeſcentes glandulas bubones:* "Alſo the glands which are "ſeated in the neck and behind the ears, very often "tumify, and are accompanied with an ulcer about "the head, neck, or ſome of the other adjacent "parts: but the glands thus tumified are denomi-"nated buboes." But at preſent it is cuſtomary with

[a] Method. Med. Lib. XIII. Charter. Tom. X. pag. 297.

us only to call tumours of the groins and arm-pits by this name. Now theſe buboes are either inflammatory, ſuppurating, or ſcirrhous, all ariſing from the common cauſes of inflammation. But there are alſo buboes which frequently ariſe in the worſt contagious diſeaſes, as in the plague; and ſometimes alſo in the venereal diſeaſe, in which laſt the inflammation is not very ſudden or violent, but uſually continues a long time before it can be reſolved, or elſe be brought to a laudable ſuppuration, frequently reſiſting even the moſt efficacious remedies. Sometimes alſo, there is a tranſlation or ſettlement (ἀπόστασις vel μετάστασις) of the morbific matter with very good ſucceſs upon theſe parts, which is then termed a metaſtaſis or apoſtaſis. And even ſometimes in men who are healthy in other reſpects, theſe tumours ſuddenly ariſe without any topical cauſe, producing firſt an inflammation, and then a ſuppuration: and theſe are the latent efforts of nature, by which ſhe ſeparates thoſe humours from the whole maſs of blood, which might prove of worſe conſequence, without giving any manifeſt ſigns of the latent nature of the diſeaſe. Hence it is that theſe parts were eſteemed by the antient phyſicians as the emunctories or drains of the viſcera; and Galen ſays [b] that the glands very eaſily receive an afflux of the humours, by reaſon of their weakneſs and ſpungy texture. Now if we conſider the ſituation of the inguinal and ſubaxillary glands, they will appear to be well adapted to receive thoſe humours, which ought to be diſcharged from the whole habit: for they are placed in the very ſoft adipoſe membrane, almoſt free from all muſcular compreſſion; having very large arteries, veins and nervous trunks, near them, from which they receive their branches. But theſe glands have ſo great a commerce or conſent with the other branches of theſe nerves, that when they are injured, theſe glands are often immediately inflamed and ſwelled. Thus I have frequently ſeen a very

[b] Ibid. pag. 296.

pain-

painful paronychia produce a ſudden tumour in the axilla, even though the diſorder was ſeated in the end of the finger. When a woman unfortunately run a needle up under her nail, ſo as to injure the nervous ſubſtance which is there ſeated with the moſt acute pain, I was ſurprized to find that in a quarter of an hour after there was a conſiderable tumour in the arm-pit of the ſame ſide. From hence the reaſon is evident why Hippocrates[c] ſays, *Febres poſt bubones ortæ, niſi ephemeræ fuerint, malum.* "Fevers ariſing "after buboes, are bad, unleſs they are (ephemera's) "but of a day's continuance." For he here intends that the fever denotes a fruitleſs attempt of nature to expel the morbific matter by abſceſs. And therefore fevers ariſing from ſuch a latent cauſe muſt be very ſtubborn, unleſs they are ephemera's which run thro' their courſe, or terminate within twenty-four hours, and ſignify the ſtrength of nature overpowering the diſeaſe. And in another place he ſays, *bubones febribus ſuccedentes deteriores, ſi in acutis ab initio decreſcant.* "That buboes ariſing after fevers are bad, if they "decreaſe from the beginning in acute diſtempers." For theſe then denote an inſufficient endeavour of nature, and in dangerous fevers muſt be always bad: For buboes ſeldom appear in fevers, unleſs they are very acute. I remember myſelf to have ſeen buboes in the worſt ſpecies of the ſmall-pox, and in the plague; all who have wrote upon that diſtemper teſtify that they are very frequent.

Parotides.] This name denotes a tumour of the glands behind the ears, which is called parotis by the Greeks, which is as much as to ſay, an abſceſs behind or under the ear. They are alſo by Hippocrates often called τὰ παρ' ὦς ἐπάρματα, *vel ſimpliciter* τὰ παρ' ὦς. What has been ſaid concerning the inguinal and ſubaxillary glands, as being ſeated in the ſoft fat, and freed

[c] Epidem. Lib. II. Charter. Tom. IX. pag. 162. & Aphor. 55. Sect. 4. ibidem, pag. 170.

from the compreſſure of muſcles, *etc.* The ſame is alſo true concerning the parotides; for they occupy that cavity which we find at the root of the ear betwixt the maſtoide proceſs of the ſkull, and the condyloide head of the lower jaw, from whence they are extended downward and backward under the lobe of the external ear. They likewiſe receive large branches from the adjacent external carotid artery. The tumours of theſe glands appear much more frequently in diſeaſes than buboes, and Hippocrates from thence deduces part of his prognoſis in many diſtempers, as will hereafter appear. But it may be ſufficient for us at preſent only to remark from Celſus[d], *Sub ipſis vero auribus oriri παρωτίδες ſolent, modo in ſecundo valetudine, ibidem inflammatione orta; modo poſt longas febres, illuc impetu morbi converſo. Id abſceſſus genus eſt. Itaque nullam novam curationem deſiderat: animadverſionem tantummodo hanc habet neceſſariam, ut, ſi ſine morbo id intumuit, primum reprimentibus fiat: ſi ex adverſa valetudine, illud inimicum eſt, maturarique et quam primum aperiri commodius eſt.* "But under the ears "themſelves the parotides uſually ariſe, as well in an "ill ſtate of health, or after an inflammation in them, "as after long fevers when the violence of the diſeaſe "tends to that part. This is a kind of abſceſs, and "therefore does not require any different method of "treatment; only this caution is neceſſary to be ob"ſerved, that if they ſwell without a diſeaſe, trial "ought firſt to be made with repelling medicines; "but if they ariſe from an ill ſtate of health, it is "from ſomething offenſive to nature, whence it will "be more convenient to maturate and open it as "ſoon as poſſible."

Furuncle or bile.] This is a very painful inflammatory tumour, ſeated in the external ſurface of the body, and ſlowly tending to ſuppuration, appearing very red, and when once the abſceſs is opened, there generally appears concreted blood in the bottom,

[d] Lib. VI. cap. 16. pag. 391, 392.

whence

whence it is uſually denominated a *bleeding-ulcer*. Theſe kinds of abſceſſes ſometimes prove epidemical, and not only invade many men in the ſame country, but alſo people of different countries, and appear in different parts of the body. Celſus[e] gives us the following deſcription of a furuncle: *Furunculus vero eſt tuberculum acutum cum inflammatione, et dolore; maximeque ubi jam in pus vergit. Qui ubi adapertus eſt, et exiit pus, ſubter apparet pars carnis in pus verſa, pars corrupta ſubalbida, ſubrubra; quem ventriculum quidam furunculi nominant. In eo nullum periculum eſt, etiamſi nulla curatio adhibuatur: matureſcit enim per ſe atque erumpit. Sed dolor efficit, ut potior medicina ſit, quæ maturius liberet.* "But a furuncle is a ſharp pointed tumour with inflammation and pain, which are the moſt violent when it is about turning to ſuppuration. When this is opened and the matter diſcharged, there appears underneath, part of the fleſh turned to matter, part of it corrupted and of a whitiſh colour, and part of it a reddiſh colour, which part is denominated the ventricle or ſtomach of the boil. There is no danger in this tumour, even though no care be taken of it, for it both ripens and breaks out of itſelf; but it occaſions a pain, and therefore it may be proper to uſe medicines which ſoon maturate or free it from the pain." As a mild reſolution can never be expected in a furuncle, the whole intention of the cure conſiſts in bringing it as ſoon as poſſible to ſuppuration; and becauſe theſe tumours are generally difficult to bring to a perfect maturation, therefore it is uſual to add ſuch things to emollient applications, as are capable of exciting a little greater motion in the part to be ſuppurated: whence Celſus[f] pronounces *proprium furunculi medicamentum galbanum eſt*; "that galbanum is a medicine proper to a furuncle."

[e] Lib. V. cap. 28. n° 8. pag. 324.
[f] Ibidem.

Anthraces.] When the external ſkin and ſubjacent panniculus adipoſus are ſuddenly corrupted by a violent inflammation, ſo as to form a dry hard ſcab or eſchar, which being perfectly dead, ought to be ſeparated from the living parts by ſuppuration, that inflammation is then uſually called anthrax, or a burning coal. The writers of obſervations teſtify, that this is a frequent diſorder in the plague, eſpecially when the fury of the diſeaſe is mitigated, and the latent virus derived to ſome particular part of the body by victorious nature. But there are two kinds of anthraces deſcribed by Galen [r], where he treats of the different kinds of inflammation. *Quando influens ſanguis admodum calidus fuerit, et craſſus in quamcumque partem confeſtim fluxerit, illam adurit, ulcuſque cruſtam habens efficit. Quidquid autem circumſtat, in ferventem inflammationem attollit, et valide dolentem. Vocatur autem ille affectus anthrax. Quod ſi influens ſanguis niger ſit, craſſus, fæculentus, ac fervidus, qualis eſt prior, admixtamque quandam ſaniem habeat tenuem, puſtulas in ſuperficie cutis excitat, ſimiles his, quæ ab igne fiunt: quibus ruptis ſub ipſis cruſtoſum ulcus invenitur. Eſt autem his affectus etiam anthrax.* "When the influent blood is "very hot and thick, flowing very rapidly into a "part, it burns up the ſkin, and forms an ulcer with "a cruſt or ſcab: But all the circumjacent parts it "raiſes into a hot inflammation, which is extremely "painful. But this diſorder is termed anthrax; but "if the influent blood is black, thick, feculent, and "very hot like the former, being alſo mixt with "a kind of thin ſanies, it cauſes puſtules in the ſurface of the ſkin, like thoſe which are raiſed by "fire; which being ruptured, an ulcer is perceived "under the cruſt. But this laſt diſorder is alſo an "anthrax." The firſt ſpecies of an anthrax is moſt agreeable to the common ſort, but the definition given

[r] Method. med. ad Glaucon. Lib. II. cap. 1. Charter. Tom. X. pag. 269.

of

of the latter kind, denotes a milder ſpecies of the ſame diſorder. The cure conſiſts in procuring a ſuppuration all round the anthrax, ſo as preſently to ſeparate it from the adjacent living veſſels; for the ſubſtance of the anthrax itſelf can never be converted into matter. The moſt emollient remedies only are therefore proper in this caſe.

Carbuncle.] This is related to the anthrax, but ſomewhat milder. The modern ſurgeons generally call by this name an ulceration of the ſkin in ſeveral parts, following after a very violent and painful inflammation, in which there is alſo ſome fragments of the panniculus adipoſus diſcharged from the ulcerations. But the diſorder which Celſus [b] deſcribes by this name, ſeems to have been different from theſe carbuncles: for he ſays, *rubor eſt, ſuperque eum non nimium puſtulæ eminent, maxime nigræ, interdum ſublividæ, aut pallidæ. In iis ſanies eſſe videtur; infra color niger eſt. Ipſum corpus aridum et durius quam naturaliter oportet. Circaque quaſi cruſta eſt; æque inflammatione cingitur. Neque in eo loco levari cutis poteſt, ſed inferiori carni quaſi affixa eſt. Somnus urget. Nonnunquam horror, aut febris oritur, aut utrumque. Idque vitium ſubteractis quaſi quibuſdam radicibus ſerpit interdum celerius, interdum tardius.* "That it is red, having "puſtules ariſing upon the ſurface not very high, ge-"nerally black, but ſometimes livid or pale, in "which there ſeems to be a ſanies, and underneath "there is a black colour. The body itſelf appears "drier and harder than it naturally ought, and about "the edge there is a ſort of cruſt circumveſted with "an inflammation. Nor can the ſkin be taken off in "that part, but it ſeems as it were faſtened to the fleſh "beneath, the patient is ſleepy, and ſometimes taken "with a ſhivering or a fever, or both. When the "diſorder is once fixed, it ſpreads as it were with "roots ſometimes faſter, and ſometimes ſlower."

[b] A. Corn. Celſ. Med. Lib. V. cap. 28. n°. 1. pag. 315, 316.

The cure which he afterwards ſubjoins, ſufficiently proves that theſe carbuncles were malignant, and perfectly deſtroyed or mortified the part which they invaded. For he immediately orders them to be cauterized, which he adds, may be done without pain, becauſe that fleſh is dead; and he orders the cauterization to be continued until every part is ſenſible of the pain. But how dangerous theſe carbuncles ſometimes were, is alſo evident from Celſus in the ſame place, who ſays that if this diſorder is ſeated in the ſtomach or fauces, it often ſuddenly ſtrangles the patient.

Phymata.] Galen [i] will have phymata derived from ſprouting (ἀπὸ τῆς φύεσθαι) for he ſays: *Ab iis, quæ ex terra progerminant, homines phymata vocaverunt tumores præter naturam, qui omnino ſine cauſa externa proveniunt: ſed potiſſimum ſic nominant eos, qui ad externum locum impelluntur. Quia autem aliud nomen non habetur, etiam latos, et paulo naturalibus partibus elatiores (tumores) eodem nomine appellant.* "That phy-
"ſicians have called phymata thoſe preternatural tu-
"mours which ariſe without any external cauſe, like
"things which grow out of the earth: but they
"chiefly call thoſe tumours by this name which are
"ſeated externally. But for want of another name,
"they have thus called even broad tumours ſeated
"prominent in the natural organs." From hence the uſe of this term ſeems to have been a little uncertain, and that even buboes and other ſuppurations of the glands, were ſometimes thus called, is evident from another paſſage in Galen [k], where he ſays: *Imprimis autem quadam phymata appellantur inflammationes nonnullæ ſpontaneæ, ſubitiſſime natæ, citiſſime in acutum apicem elatæ et celerrime ſuppurandæ. Et plurima illorum generatio eſt in inguinibus et axillis, quod in his locis plures ſint glandulæ, quæ hanc naturam habent,*

[i] Comment. 1. in VI. Epidem. Hipp. Textu. 13. Charter. Tom. IX. pag. 375.

[k] Commentar. in Aphor. 26. Sect. 3. Charter. Tom. IX. pag. 122.

ut

ut excrementa promptiſſime in ſe recipiant. " But there " are more eſpecially ſome ſpontaneous and ſudden " inflammations which are called phymata, which very " ſoon elevate the ſkin into a ſharp tumour ſpeedily " tending to ſuppuration. Many of them are formed " in the groins and arm-pits, becauſe in theſe parts " there are many glands, whoſe office is readily to re- " ceive the excrements of the blood into themſelves." Even Hippocrates [l] terms abſceſſes which ariſe after long fevers about the joints by the name of phymata; and in another place he calls by that name a tumour in the urethra [m] itſelf tending to ſuppuration; and in another place [n] he ſo calls a vomica broke inwards. This paſſage of Hippocrates is thus expreſſed by Celſus [o], *Quibus in fiſtula urinæ minuti abſceſſus, quos φύματα Græci vocant, eſſe cœperant, iis, ubi pus ea parte profluxit, ſanitas redditur.* " In thoſe who have abſceſſes " ſeated in the urethra, which the Greeks call phy- " mata, when they diſcharge matter, they begin to " recover their health." The ſame author in another place [p] uſes the name phymata barely to denote incipient tumours. But where he treats of the different kinds of abſceſſes [q], he gives the following more large deſcription of a phyma, when he ſays, *Phyma vero nominatur tuberculum furunculo ſimile, ſed rotundius et plenius, ſæpe etiam majus. Nam furunculus ovi dimidii magnitudinem raro explet, nunquam excedit. Phyma etiam latius patere conſuevit: ſed inflammatio dolorque ſub eo minores ſunt. Ubi divulſum eſt, pus eodem modo apparet: ventriculus, qui in furunculo, non invenitur: verum omnis corrupta caro in pus vertitur. Id autem in pueris et ſæpius naſcitur, et facilius tollitur: in juvenibus rarius oritur, et difficilius curatur. Ubi ætas induravit, ne naſcitur quidem:* " But a phyma is a ſmall tu-

[l] Aphor. 44, & 45. Sect. 4. Charter. Tom. IX. pag. 163.
[m] Aphor. 8. Sect. 7. ibid. pag. 295.
[n] Aphor. 82. Sect. 4. ibid. pag. 191.
[o] A. Corn. Celſ. Medic. Lib. II. cap. 8. pag. 70.
[p] Idem, Lib. V. cap. 18. n°. 16. pag. 254.
[q] Ibid. cap. 28. n°. 9. pag. 325.

" mour

" mour like a boil, but rounder and broader, and " frequently larger. For a furuncle ſeldom arrives to " half the ſize of an egg, and never exceeds it. A " phyma alſo ſpreads itſelf uſually broader, but then " it has leſs pain and inflammation. When it is " opened there is alſo a matter found in it, but the " ventricle is not found here as in a furuncle, but all " the corrupted fleſh is changed into matter. It ariſes " more frequently in children, and is in them more " eaſily removed; in young people it happens more " rarely, and is more difficultly cured; but it does " not appear at all when age is far advanced."

From all which it is evident that an inflammatory tumour ſpeedily tending to ſuppuration, was generally termed a phyma, the knowledge and cure of which is therefore to be deduced from the hiſtory of inflammation and abſceſs.

Eryſipelas.] Concerning this, ſee what has been ſaid in the commentaries on § 380.

Meaſles.] If we conſider the account given us by Sydenham, who has the moſt accurately deſcribed the courſe of the meaſles from the beginning to the end, it will evidently appear that after a preceding fever, there are ſmall inflammatory eruptions, which ariſe in the external ſkin of the face, about the fourth day uſually in the regular kind, but ſooner or later in thoſe which are irregular, which puſtules cohering in cluſters, form red ſpots; and after this the trunk and limbs of the body begin to look red. At length on the eighth or ninth day all this redneſs again diſappears, and the broken cuticle appears, white and rough upon the ſurface of the body, almoſt as if it was ſprinkled with flour, and the cuticle falls off in little ſcales. From whence it is evident that the meaſles come near to the nature of an eryſipelas, ſince they only occupy the external integuments, or the internal membranous parts of the body, and that they are never followed with a ſuppuration, but always diſappear with a ſcaling off of the cuticle.

Small-

Small-pox.] Theſe are not eryſipelatous eruptions, like thoſe of the meaſles, but true inflammatory puſtules, tending to a mild ſuppuration, when they are of a mild and good kind, or elſe to a gangrene, when they are of the worſt kind. They not only invade the external ſurface of the body, but have been ſometimes obſerved likewiſe in the internal parts of the mouth, fauces, ſtomach and viſcera, as we ſhall declare more at large when we come to treat profeſſedly of this diſtemper. It is ſufficient at preſent for us to obſerve, that they are attended with all the true appearances of an inflammation, ending either in an abſceſs or a gangrene, and that the general rules which have been given for the cure of an inflammation and abſceſs, with that of a gangrene following, do alſo take place equally in the ſmall-pox.

Purple or red ſpots.] By this denomination are called all thoſe cutaneous exanthemata or efflorescences which are ſometimes obſerved after another diſtemper, and are frequently not attended with any injury of the functions; nor can they therefore be well ranked amongſt the other diſorders of this aphoriſm. But of theſe we ſhall treat hereafter among the ſymptoms of fevers on § 723, and the following; and it will there appear that the knowledge and cure of theſe may be deduced from the hiſtory of inflammation.

SECT. CCCCXVII.

NOR will it be difficult to deduce a knowledge from hence, concerning the event of an internal ſuppuration, in which no acceſs can be given to the hand, nor to other proper remedies; for many and great diſorders (§ 409, 413,) with collections of matter in the cavities of the body, thence follow.

From

From all that has been hitherto ſaid concerning abſceſſes and fiſtulæ, it is very evident how difficult it muſt often be to cure internal ſuppurations, to which neither the eye can penetrate, nor the hand reach. For the curative indications § 402. are equally neceſſary in the internal ſuppurations as external ones. But it is often impoſſible, or at leaſt extremely difficult, to perform what is called for by the indications; for neither can the crude humours be maturated or concocted, nor the adjacent parts be mollified or relaxed, by the uſe of ſoftening cataplaſms and fomentations, ſince there is no acceſs given to the hand. It is alſo frequently quite impoſſible to derive the ſuppurating matter outward in theſe caſes, ſo as to diſcharge it in the form of a laudable matter by an opening with a lancet; but being therefore corrupted and attenuated by heat and ſtagnation, it corrodes the adjacent parts, or elſe being abſorbed by the patulent orifices of the veins, it infects the blood with a purulent cacochymia, whence follow all the diſorders mentioned at § 406. But matter contained in an internal abſceſs being daily increaſed, will by its weight make new ſinuſes and paſſages, if it is not abſorbed by the veins, till at length making a way through the internal membranes of the thorax or abdomen, it produces an empyema or a purulent aſcites. And as the matter becomes more acrimonious and increaſed in quantity daily, it will corrupt the viſcera, and deſtroy the patient with a ſlow maraſmus attended with the greateſt miſeries.

SECT. CCCCXVIII.

IF again the neceſſity or office of the affected part towards life and health be conſidered, the difficulty of the cure and the future conſequence may be eaſily foreſeen.

If

If we know what internal part of the body is injured by the ſuppuration, we may determine from phyſiology, what maladies are to be thence expected, and the more or leſs difficulty which will be met with in the cure. Thus for example, if the liver is ſuppurated, much danger from thence may be juſtly expected, ſince that is a viſcus abſolutely neceſſary to life and health, as the formation of bile which is ſo neceſſary to chylification is produced by that viſcus. Therefore a jaundice, cachexy, dropſy, and many other diſorders are to be feared; beſides the ſubſtance of the liver is ſo friable and tender, that almoſt every part of it may by degrees be diſſolved by the long confined acrid matter; whence a tabes hepatica, and a putrid colliquative flux, follows, which ſoon deſtroy the patient. But if ſuch an abſceſs ſhould open and diſcharge its matter into the cavity of the abdomen, it will produce a purulent aſcites, with the ſame pernicious effects. The open ulcer in the liver will then daily generate more matter, and all the viſcera of the abdomen will be macerated in the ſame matter, and corrupted in a ſhort time. But if by good luck the matter contained in the abſceſs of the liver ſhould make its way through the integuments of the abdomen outwards, even then the event will be doubtful. For if pure white matter is diſcharged, the patient may recover; but if foul ſordes appear, the patient will certainly periſh, as Hippocrates[q] obſerves. Therefore the hopes are dubious in ſuch a caſe, though it is not abſolutely deſperate. But if an inflammation ariſing in the encephalon turns to a ſuppuration, and no vent is given to the matter, then it will be impoſſible to avoid a deſtruction of the tender fibres of theſe parts, which are abſolutely neceſſary to life; and therefore there can be little hopes in ſuch a caſe. There are indeed ſome rare hiſtories of wounds in the head which demonſtrate

[q] In Coacis prænot. numb. 451. & Aphor. 55. Sect. 7.

that

that matter, ichor, blood, &c. have been diſcharged by ways not well known from anatomy, out of the cavity of the cranium, and the patient has by that means eſcaped a deſperate caſe; but perhaps there is not one in a hundred who thus eſcapes. If again the vital viſcera contained in the cavity of the thorax, the heart and lungs, are invaded with an abſceſs, it is ſufficiently evident what fatal events are to be feared.



The End of VOL. III.

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